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THE

MECHANICS' MAGAZINE,

MUSEUM,

Register, Journal,

AND

GAZETTE,

JANUARY 2ND—JUNE 26TH, 1847.

EDITED BY J. C. ROBERTSON.

VOL. XLVI.

"To collect physical facts, to deduce laws, and to apply them to circumstances."—LACROIX.

LONDON:

ROBERTSON AND CO.,

MECHANICS' MAGAZINE OFFICE, No. 166, FLEET-STREET.

AGENTS: FOR EDINBURGH, J. SUTHERLAND;
GLASGOW, W. R. M'PHUN, AND DAVID ROBERTSON;
DUBLIN, MACHEN AND CO., 8, D'OLIER STREET;
PARIS, A. & W. GALIGNANI, RUE VIVIENNE;
HAMBURGH, W. CAMPBELL.

1847.

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Mechanics' Magazine,

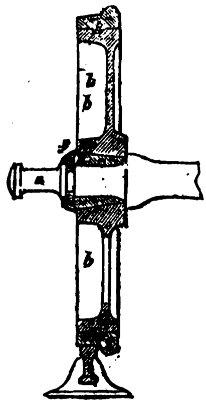
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1221.] SATURDAY, JANUARY 2, 1847. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MELLING'S PATENT EXPANDING RAILWAY WHEELS.

Fig. 1.



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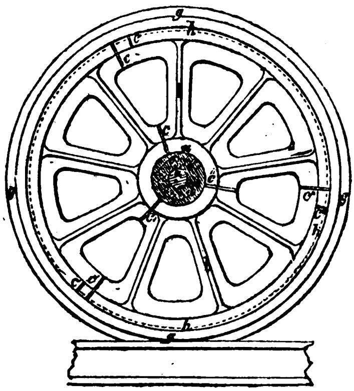

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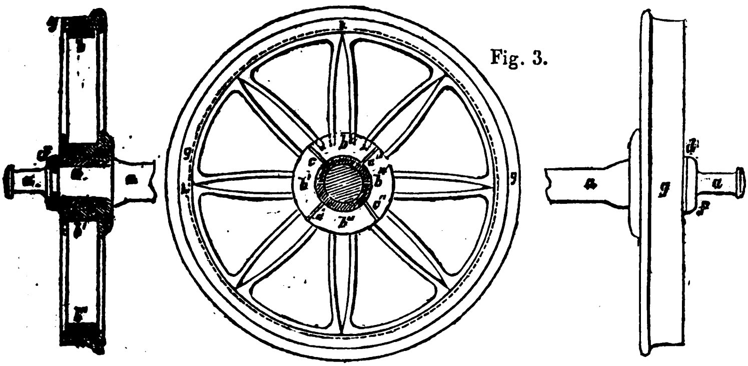

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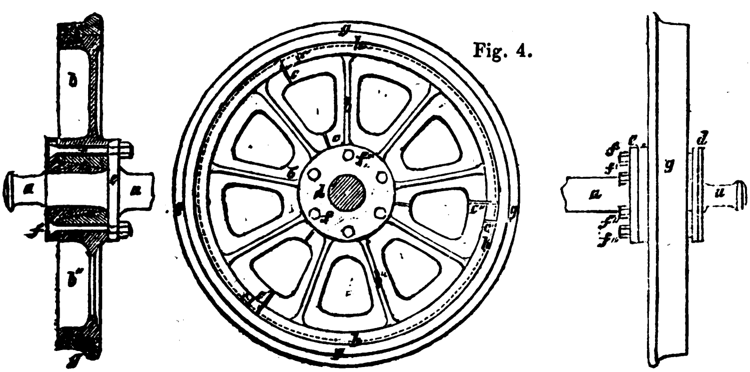

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MELLING'S PATENT EXPANDING RAILWAY WHEELS.

We have in our previous volume (pp. 506 and 507,) given the portions of Mr. Melling's recent patent which refer to his Atmospheric and High Pressure Engine, and methods of regulating the Feed of Boilers. We now proceed to lay before our readers another important section of his specification relating to Railway-Engine and Carriage Wheels, which Mr. Melling introduces by the following just and judicious observations :

The ordinary method in which railway wheels are made, is to have the nave or boss of cast-iron with wrought-iron arms cast in, but these arms are so bent as to form the inner rim or periphery of the wheel. A wrought-iron flanched tire is then shrunk on hot, in order that its contraction in cooling may cause it to adhere to the rim, to which it is further secured by rivets or bolts. Wheels are likewise frequently made wholly of cast or wrought iron, and the tires put on in the same manner. The nave being bored, the wheel is forced upon the axle by hydraulic or screw pressure, and prevented from turning upon it by a square or round key, inserted partially into the wheel, and partially into the axle. Now there are several practical objections to the plan of putting on tires as above described. *First*, if the boss be of cast-iron, and the rim and arms of wrought-iron, and the tire be too small, it will, in contracting, either bend the arms or break the tire ; and if the wheel be entirely of cast-iron, either wheel or tire must break. On the other hand, if the tire be too large, either it must be laid aside to be applied to some other wheel, or its diameter must be reduced by cutting and welding. *Second*, if the wheel be wholly of cast-iron, it is necessary the moment the tire is put on to immerse it in cold water, otherwise the heat communicated to the inner rim, arms, and nave would cause them to expand and break, and this sudden cooling always materially injures the malleable nature of the tire iron. *Third*, the holes which are drilled through the tire for fastening it to the rim by rivets or bolts, render it weaker at these parts, as is proved by the fact that tires generally break across these holes. Again, these rivets or bolts are invariably countersunk, or fitted into conical holes bored from the outside of the tire ; a form which has a strong tendency to break the tire if the rivets or bolts be drawn too tight. These rivets or bolts are, besides, very liable to work loose.

To remedy these various defects, Mr. Melling proceeds as follows :

The body of the wheel (that is, the nave, arms, and inner rim,) is made in segments, two, three or more, as I find convenient. These segments are connected by feathers, and groove, with each other ; and each is made with a groove on its periphery, (coinciding in position with the grooves of all the other segments,) which receives a corresponding fillet rolled on the under side of the tire ; and the hole in the nave for the reception of the axle is bored of larger diameter than the axle, in order to leave room for the insertion around it from the outside of a hollow expanding piece, which is interiorly of the same size and form as the axle, and fits exactly upon it, and is exteriorly of the form of a cone, so that in proportion as this expanding piece is forced in, the segments of the wheel are expanded, the tire tightened, and the axis more firmly gripped. The conical expanding piece may be made in parts, or it may be made in the entire piece, and prevented from revolving upon the axle by a key. It is secured in its place by a ring in two halves, which fits into a recess in the axle, and is kept together by another encircling ring or hoop. The advantages of this wheel, which from its peculiar properties I call the "Expanding Wheel," are,—*Firstly*, that the wheel can be accommodated to the size of the tire, without that extreme nicety of workmanship which is at present required to prevent the tire from being too slack, or breaking from being too tight. *Secondly*, that there being a fillet on the under part of the tire corresponding with a groove in the periphery of the inner rim, no rivets or bolts are required to keep it in its place, and, consequently, that no parts of it are rendered weaker than others. *Thirdly*, that as the tire is put on cold, its malleability is not injured by slaking, as is very commonly the case with cast-iron wheels as now put together. *Fourthly*, that as tires can be taken off and put on wheels without being heated, and consequently with very little delay or expense, it will be necessary to keep only duplicate tires instead of duplicate wheels and axles, as is now the practice. *Fifthly*, that as the tires are put on cold they can be casehardened, and all the advantage of steel tires be thereby obtained at far less cost. (When steel tires are heated and shrunk hot upon a wheel on the old plan, they are found when cold to be out of truth even though previously rolled, and before they are fit for use they have to be ground up in the lathe, whereas with the expanding wheel they can be put on cold just as they leave the rolls.) *Sixthly*, that a separate apparatus is not required for blocking, as each wheel forms its

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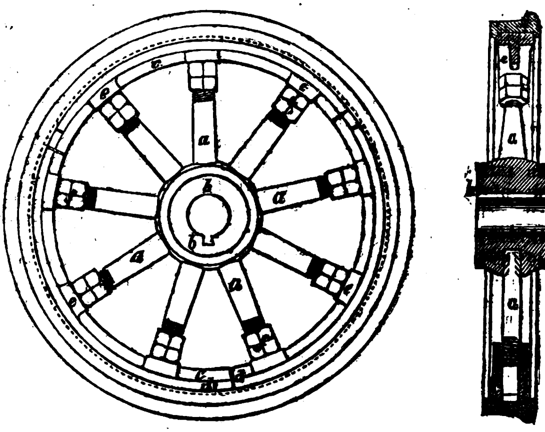
Fig. 5.



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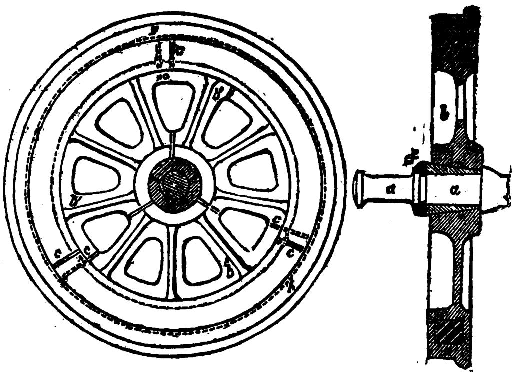

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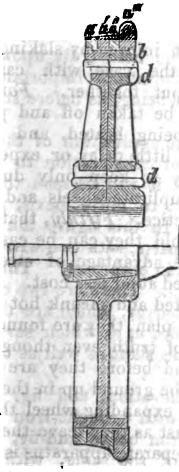

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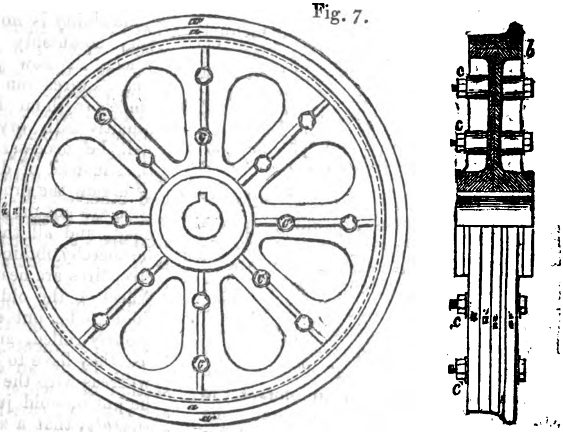

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own block. And, *seventhly*, that the wheel (the tire and rim) being cast in separate parts it is not liable to break from contraction in cooling, as is the case when cast whole, in consequence of the unequal distribution of metal in the boss, arms, and rim. Figure 1 represents an elevation of one of a pair of cast-iron wheels and wrought-iron axle constructed on the preceding plan. Figure 2 is an end view of the same. *a*, is the wrought-iron axle; *b*, *b'*, *b''*, the segments before mentioned, which are in this instance three in number. *c*, *c'*, *c''*, show where the segments meet, and are feathered and grooved into each other. *d*, is the expanding cone, which in this wheel is supposed to be in three parts. *e*, is a hoop made in halves for holding the cone in its place, which fits into a corresponding recess in the axle. *f*, is another hoop put over the hoop *e* to hold it together, which comes flush with the journal, (see fig. 1,) and prevents its slipping off by the motion of the carriage, (a point to be guarded against,) as it is clear that any end stress that may be given to the cone must be sustained by the hoop *e*. *g*, the wrought-iron tire or hoop. *h*, the fillet which is rolled on the tire and fits into a groove in the periphery of wheel, to prevent the tire from slipping off sideways.

Fig. 3 represents side and end views of a pair of wheels with wrought-iron arms cast in the boss. Here also the arms form the inner rim of the wheel; but instead of the tire being rolled with a fillet which fits into a groove in the periphery of the rim, the rim fits into a groove rolled in the tire, which permits the arms and rim to be made of plain flat iron. The wheel is in other respects the same as that represented in figs. 1 and 2.

Fig. 4 exhibits a variation in the manner of securing the cone. In this case the cone *d* has a flanch outside, and the axle a corresponding flanch *e*, and the tightening or expanding of the pieces is effected by drawing these flanches together by the countersunk headed bolts, *f*, *f'*, *f''*, *f'''*, &c., &c.

Fig. 5 represents a sectional elevation of a wheel in which the expanding system adopted in the preceding cases is somewhat modified. The arms, *a a a*, are of wrought-iron, either tubular or solid, and are cast in the boss *b*, which is whole. The inner rim, *c*, is of cast-iron in segments, which are feathered and grooved where they meet each other, as at *d*, *d'*, *d''*, and have bosses on the inside, *e e e*, to receive the arms. The outer extremities of these arms are screwed and have double nuts, *f f f*, by means of which the segments may be expanded. I consider this plan, however, to be far inferior to that of expanding by a cone, as great care would be required to adjust the nuts, *f f f*, so as to throw equal stress upon each segment.

Fig. 6 is an elevation and section of a wheel, the rim of which is filled with wood, *i*. In all other respects it is similar to the wheel shown in figures 1 and 2. A great advantage is here derived from putting on the tire cold, as the wood is not charred.

Fig. 7 is an elevation and section of a wheel in which the tire is formed out of several ordinary sized bars, four in number, *a*, *a'*, *a''*, *a'''*, as shown in the drawing. To hold these bars together, the wheel is cast in halves with a flanch *b*, *b'*, on each side bearing upon the outside of the tire; and these halves are coupled together either by bolts and nuts *c*, *c*, as shown in fig. 7, or by gibs and cotters *d*, *d'*, as shown in fig. 8. Or the wheel, instead of being in halves, may be made in three or more segments, with a similar flanch on each side for holding the tire, and expanded by a cone. Should it be preferred to have the tire solid, these rings may be put together, heated in the furnace and welded by hammer. The object aimed at in this improvement is to afford greater facility for welding the tires, with more certainty as to their being sound when so welded. Bars of this description will also be more readily procured, and at a much less cost than the ordinary massive bars.

Fig. 10 is a section of a tire, intended to show that when rolled with a fillet on the under side, as before described, that fillet may be made of various suitable forms. Here, for example, it is represented as triangular instead of rectangular, as in the former instances. All that is requisite is, that the tire shall be held truly upon the wheel, which is of the utmost importance in blocking; the wheel being, as before stated, its own block.

Fig. 11 shows the application of the expanding principle of construction to strap pulleys, from which it will be seen that it may also be applied to mitre, bevil, spur, and other wheels. In this figure the boss *a* is shown in three parts, with two wrought-iron arms *b*, *b*, cast in each part. The rim is of light sheet iron. There are two cones *d*, *d*, each in two halves, which are drawn together by two bolts *e*, *e'*, which serve to fix the pulley on the shaft as well as to expand the segments.

Fig. 12 is an elevation, and fig. 13 a section of a wheel with wrought-iron arms and rim, and cast-iron boss; and fig. 14 is an end elevation of the same, with the tire or outer hoop removed. *a* is the

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Fig. 11.

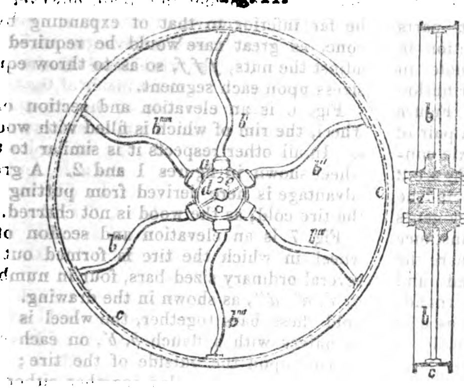


Fig. 10.

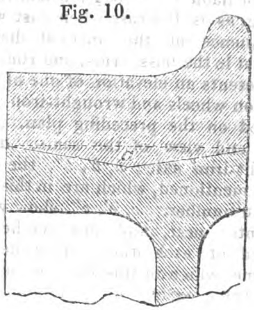


Fig. 12.

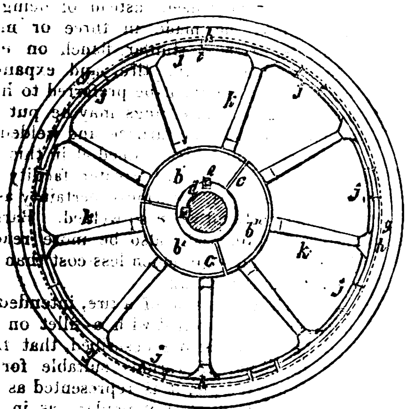


Fig. 13.

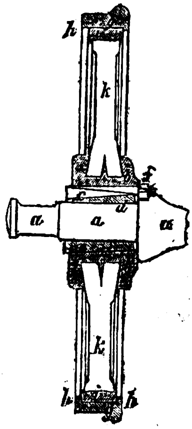


Fig. 14.

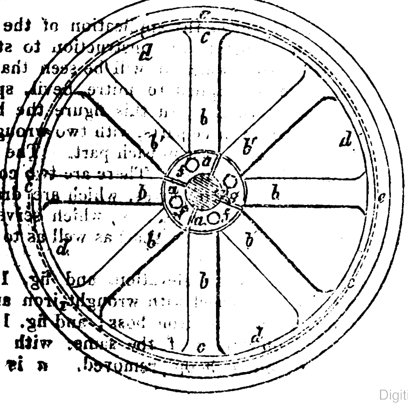
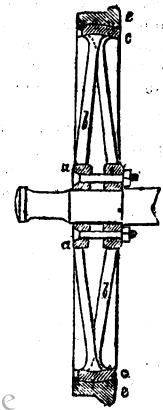


Fig. 15.



wrought-iron axle (shown as parted in fig. 13); *b*, *b′*, *b″* segments forming the boss of wheel; *c*, *c′*, *c″*, show where these segments meet, and are feathered and grooved into each other; *d*, the cone (which is in this wheel whole); *e*, a key for holding the cone in its place, which is bevelled on the underside, in a contrary direction to the incline of the cone, and is secured, when up, by a nut, *f*; *g*, is the wrought-iron tire, or hoop; *h*, *h′*, fillets rolled on the tire, which fit on to each side of rim, *i*, to prevent the tire slipping off sideways. The inner rim or periphery, *i*, is in as many parts or segments as there are arms in the wheel, and to each of these parts or segments there is welded an arm, *k*.

The joining surfaces of the segments are of a triangular form, as shown at *j*, *j*, *j*, that is to say, there is a triangular projection on one which fits into a corresponding triangular recess in the next, and so on. I prefer the triangular form as being most easily wrought, but a rectangular or any other simple form may also be adopted. When the segments have each had an arm welded to them, they are sent into the foundry to have the boss or nave cast on, for which purpose a mould is formed, and the arms inserted in their proper position, which is determined by a trammel. The metal is then poured in. If the wheel is to be in parts, "parting plates" of the usual description are placed in the lines of division, *e*, *c′*, *c″*; or the segments may be cast separately, with the proper number of arms on each. The boss being cast on the arms, it is then only necessary to insert the cone and put on the tire in the same manner as before described.

Figure 15 is an elevation, and fig. 16 a section, of a wheel made wholly of wrought iron. Here there are two distinct bosses, *a*, *a′*, employed, and each boss is divided into four parts, or segments. The bosses are placed at a distance from each other on the axle (see fig. 16.) To each boss is welded an equal number of arms, *b*, *b*, placed with their edges in the running direction, so as to offer as little surface as possible to atmospheric resistance. To each arm, *b*, is welded a corresponding segment of the rim, *c*, and these segments are separated from each other, as shown at *d*, *d*. As all the arms are placed in the centre of the rim, and half their number in the centre of each boss, it is obvious that they will stand in an angular direction with respect to each other; an arrangement which gives great lateral strength to the wheel. Each arm being welded to its corresponding segment of rim, and half of the arms to each boss at the proper angle, the tire, *e*, is then put on. To effect this, the diameter of the wheel is reduced for the time being, by drawing the segments nearer to the centre of the wheel, and then moving them out again; for as the inside of the tire is concave, and the outside of the rim convex, this reduction of diameter is necessary to prevent the tire from slipping off sideways. The wheel is next put on the axle, and the rim forced against the tire, by drawing the bosses together by the bolts, *f*, *f*; the stress being taken off these bolts, and the wheel prevented from turning upon the axle by a a key, *g*, in each boss.

Figure 17, is an elevation of an axle of a new form, and fig. 18 an end section through the same. This axle is made out of common sized bars of iron, either round, square, or of any other suitable form; these bars, *a*, *a*, *a*, &c., are put together and welded at each end for the journals *b′*, *b″*, and wheel seats, *c*, *c′*, and twisted by suitable machinery betwixt the wheel seats. An axle of this form may be made at a cheap rate, and will possess more strength with less weight than any now in use. Tires may also be formed of common sized bars of iron twisted together in the same way, and then welded.

ADAMS'S DISCOVERY.

Sir,—In the summer and autumn of 1844 I was a private pupil of Mr. Adams; and I know perfectly well that in December of that year his calculations were so much talked of amongst the members of the university, that I remember saying to him myself one day, "They tell me you have discovered a new planet." Even at that time the calculations covered a fearful amount of paper, which made us (his pupils) stare not a little. As these facts are well known to some scores of Cambridge men, my anonymous signature will not lessen the weight of the testimony.

The long and the short of the matter is simply this:—Adams was determined not to make any public statement of his opinions until the whole of his investigation amounted to proof positive. The Frenchman begins to shout out "before he is out of the wood." The mere open belief, or conjecture, that the disturbances were caused by an unknown planet—so far from being anything wonderful, is what would occur to almost any schoolboy who had dipped into "Herschel's Astronomy;" in fact, if there are any disturbances at all, this inference would

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be made by ninety-nine out of every hundred who know what a "disturbance," in astronomical language, means. The whole affair is almost a fac-simile of Newton's discovery, and Hooke's absurd claims to priority. The notion of attracting force as a property of matter—and, more than that, the *law* of that attraction, was common enough before Newton began his discoveries. Directly, however, by dint of hard thinking and first-rate mathematical skill, he had verified this (up till then) *mere hypothesis*, by actual figures, up jumps Hooke, and bawls out, "I told you so!" Newton's own reply to this is so good, that I cannot forbear quoting it:

"Now, is not this very fine? Mathematicians that find out, settle, and do all the business, must content themselves with being nothing but dry calculators and drudges; and another that does nothing but pretend, and grasp at all things, must carry away all the invention as well of those that were to follow him, as those that went before." And Adams, like Newton, might well say, "This carriage towards me is very strange and undeserved."

Arago's harangue in the *Comptes Rendus* is simply disgusting. If any one wishes to see how far French vanity can stultify and degrade a man he has only to read this precious rant, for such it certainly is. I speak warmly, for it is quite impossible to read this mean and miserable effusion without indignation and contempt. Will Englishmen believe, that in his blind rage and folly he actually says that "Adams's name ought not *to be even mentioned in any way* in connection with the discovery!!!" Can bigotry and impudence go further?

By the way, our own Astronomer Royal would have done well to recollect the passage above quoted from Newton's own letter, before he wrote that *extremely unphilosophical* sentence, quoted by "Exoniensis," about "a character far superior to that of the able or enterprising, or industrious *mathematician*, viz. the *philosopher*." A *philosopher*, according to the context, appears to be a person who believes a theory before he has certain grounds for his belief.

For Adams, who is the "able, &c. mathematician" who, with painful efforts and consummate skill, extracts from the long and dark labyrinths of analytical calculation, a clear and evident result—this man is, according to our Astronomer Royal, a character far inferior to the "philosophic" Le Verrier, who jumps at a conclusion before he has any right to do so—who, either discomfited by the difficulty or appalled by the labour which Adams fought and conquered, relinquishes his task of *proving*, and takes to that much pleasanter way of becoming famous, viz. *bold guessing*. Is this philosophical? Is it common sense? No one entertains a more sincere and deep respect for the high scientific character of Airy, the Astronomer Royal, than I do; but such unjust and unreasonable language is not to be tolerated even in him—and I cite the language of Newton himself in judgment against him. If "undoubting confidence" in a general theory is to constitute that "far superior character" which the Astronomer Royal has set up for us to worship—then I beg leave modestly to insinuate that I, "the present writer of the present letter," must, of necessity, be one of the greatest of these "superior characters," inasmuch as I entertain "undoubting confidence" in the theory that light, heat, electricity, chemical action, and all other kinds of action whatsoever, are nothing on earth but different kinds of *motion*, either in the ultimate particles of bodies, or in the elastic medium called "ether." And for the first part of my creed, I refer to Professor Airy's own tract on the undulatory theory. Unfortunately, I cannot say that as yet I have fully proved all this, but that does not matter; like Philosopher Le Verrier, I say unto all whom it may concern, "Look among the motions which I have indicated, and ye shall see light, &c., well!"

As then, Adams, like Newton, is to be robbed of his hard-earned reward, because, in addition to his consummate abilities as a mathematician, he is possessed of those ever rarer qualities—modesty and patience, the British nation must see that justice is done. A good opportunity for this has been afforded in the recent edition of *Whewell's History of the Inductive Sciences*—whether used or not, I cannot say. But, "A prophet hath no honour in his own country, and among his own kin." Your correspondent,

A. H.

P.S. If any one has any particular wish

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to have my name as a guarantee for my assertion, they are perfectly welcome to it by sending their address to you.

THE EXPERIMENTAL BRIGS. CAPTAIN HARRIS, IN REPLY TO CAPTAIN FISHBOURNE.

Sir,—I feel extremely diffident in again desiring to trespass on your columns, with a subject that must long since have ceased to interest your general readers; for, as Captain Fishbourne has founded his defence on recrimination, I should scarcely be justified in neglecting to reply; but as I neither indulge the *cacoethes scribendi*, nor deem an argument proved by having the last word, I shall leave that method open to Captain F. if he is inclined to avail himself of it, and consider this my last essay on the subject of the experimental brigs.

To render my subject clearer, I must follow Captain Fishbourne, in detail, through such passages as may require attention. The first assumes that I have given him credit for *writing* dispassionately, and thus appropriates a compliment that few would be inclined to pay him, and which my sentence is scarcely capable of conveying. My words were, "A captain may be pardoned for some little prejudice in speaking of his own ship, loving her (next to his wife) he may perhaps be a little blind to her imperfections; but an officer who *sits* dispassionately by the fire at the Naval Club, to write down a ship that he has hardly seen under canvass, if his arguments prove partial, and his statements incorrect, has no such excuse to offer;" the meaning of which is, I hope, sufficiently clear to acquit me of such flattery to one whose writings, in every page, *are wanting* in dispassionate judgment.

Captain Fishbourne's explanation of an apparent contradiction in his first letter, relative to the effect of draught of water on a ship's weatherly qualities, which I was not singular in misunderstanding, does not require any further comment.

Captain Fishbourne asserted, that "a fine run" was *dangerous* in a following sea, if taken a-back, and in making a stern board. I brought forward the observations made in many voyages across the Bay, which led me to a contrary opinion; and I confess that, as far as science has hitherto gone in ship building, I would rather trust to hard-earned experience in many a heavy gale, than to the conclusions arrived at by a deep study of Chapman, and other scientific authors. What difference Sir W. Symonds may have thought proper to make between the forms of the *Pantaloon* and *Flying-fish* was not the subject under discussion; but I am quite sure that the gallant officer was not led to place the centre of gravity farther aft in the *Flying-fish* from any apprehension that either the *Columbine* or *Pantaloon* were in danger of disappearing *stern* foremost. I cannot, however, allow the latter part of this paragraph in Captain F.'s letter to pass so easily. He says, "Therefore, in proportion as Captain Harris establishes this point as perfect in the *Pantaloon*, he also establishes a defect in the *Flying-fish*."

To show that a fine run *is not dangerous*, I quoted experience in a vessel of "finer run" than the *Flying-fish*; and if there was no danger in the *Pantaloon* on this account, there could, by Captain Fishbourne's own showing, be none in the *Flying-fish*, which was sufficient to meet his argument; and any futher conclusions that he may be induced to draw, are only endeavours to turn the stream of argument into a different channel.

Captain Fishbourne endeavours to show that the draught of water of the *Espiègle* was less during the last experimental cruise, than that of the *Flying-fish*, which was not the case; and here I have the advantage of personal inspection which Captain F. had not, and I take leave to remark that it is very difficult to obtain correct information on this point; but I may add that the first order given by me respecting the *Flying-fish*, was that her draught of water should be taken every evening before sunset, and entered in the log; this was done whenever the weather permitted; and when complete, with three months' provisions, 40 tons of water, and all stores for channel service, her draught was—

First Cruise.

	ft.	in.
Afore	13	6
Abaft	14	7
Mean	14	0½
And her mid-port	4	3½

After which she took in 7 tons of ballast, and 14 days' provisions, when her draught became,—

Last Cruise.

	ft.	in.
Afore . . .	13	10
Abaft . . .	14	7
Mean . . .	14	2¼
And her mid-port .	4	1¾

That her mean draught was on the 1st March, 1845, 14 ft. 4 in., I most positively deny, and whoever made such a statement is responsible for it. We now come to the *Espiègle*.

On January 31st, when I commanded that sloop, her draught furnished by the carpenter, and verified by me, was—

	ft.	in.
Afore	12	9
Abaft	16	0
Mean (not considering false keel)	13	10½
Mid-port	4	7

She had at this time 36 tons of water, and three months' provisions. On March 4th, she completed water to 39 tons, and provisions to five months, which would immerse her 1½ inches more, giving her mean draught 14 ft., mid-port 4 ft. 5½ ins., to which mean draught must be added 6⅜, being half the false keel, which was not included, making the mean draught during

Last Cruise.

	ft.	in.
Espiègle . .	14	6⅜
Flying-fish . .	14	2½

Espiègle drawing 3⅞ in. more than the *Flying-fish*. How, then, can Captain Fishbourne assert that her mean draught was half an inch less than the *Flying-fish?* Simply because his informant told him only half the story, and merely asked him "to take out the chesnut," without telling him that he would burn his fingers. The fact is, that on March 4, after the brigs had been reported ready for sea, and the signal was made to weigh, *Espiègle* made "not ready." A lighter came alongside, and she completed to five months' keeping, the brigs waiting nearly two hours; this additional weight was added to her credit in the cruise, but not to her draught of water, which we are improperly allowed to suppose remained the same as on March 1. Thus we find that Captain F. has been doubly misled, for he has been allowed to publish an egregious error in the draught of both vessels; showing a disposition, either in his informant or himself, to take advantage of a circumstance (not generally known) to raise the *Espiègle* higher *out* of the water, and *in* the public mind, than she was entitled to; forgetting that *honos alit artes*.

The two statements stand thus:

According to Captain Fishbourne,

	ft.	in.	
Espiègle . .	4	8½	Mid-port.
Flying-fish . .	3	10	
Difference	0	10½	

According to Captain Harris,

	ft.	in.	
Espiègle . .	4	5½	Mid-port.
Flying-fish . .	4	1¾	
Difference	0	3¾	

The difference between the statements (6¾ inches) may tend to elucidate the mistake of 45 tons weight, which Captain Fishbourne so cunningly endeavoured to transfer from his own shoulders to mine. Following up his misstatements, Captain Fishbourne says, "But this is to give Captain Harris's argument credit for being worth something, whereas it is worth nothing; for what does it amount to? Why, simply this, that if the midship port be a certain height, it matters little what the height the other ports may be of." By what means Captain Fishbourne has made my words capable of such a construction, I know not. But if Captain F. had correctly filled the columns in his table, he would have discovered, that between the *Flying-fish* and *Espiègle*, the height of all the other ports is in an almost exact ratio to their midship ports, and therefore, if the latter was established as of greater height than the *Espiègle's* on a wind, it follows that the others were *so* also. A little more correctness, and a little more consideration, might have saved Captain F. the trouble of using such unwonted criticism; but a graver error follows in the table, as he first gives the *Espiègle* credit for five months' provisions when she had them *not:* and then from the height of ports (taken without them) he deducts 1½ inches, making together another mistake of 3 inches, while he speaks of "Captain Harris's inaccuracy;" as if it were not enough to use false quantities, but that these also should be misapplied. And opposite we find the *Fly-*

ing-fish's draught of water stated to be 14 feet 8 inches forward, and 14 ft. 8 in. abaft, thereby showing that she was sailed on "even keel" with a mean draught of 14 ft. 8 in., while he has before quoted it at 14 ft. 4 in.! Your readers, sir, will doubtless observe the weight of Captain Fishbourne's arguments, which may be measured at the rate of 6 tons to an inch of displacement. It seems unnecessary to contradict such absurdities. Captain F. remarks, "If Captain H. attaches value to the indications of the clineometer, he must be nearly the only officer who does." The value I attach to the clineometer is, that it assists the judgment; and though its indications are not strictly correct, it has one marked advantage, *it* is without prejudice, and should afford a *comparison*, which even an unprejudiced eye is incapable of; it cannot favour one ship more than another; but it unfortunately told a tale against the *Espiègle*, and is of course condemned by her thick-and-thin advocate. From one who professes himself the supporter of science, I am surprised to find remarks condemnatory of the best means hitherto invented for registering a ship's motion; in this respect Captain F. departs from his principles, and is contented to leave all to the eye or guess-work; and as I have no other means (than the pendulum) of proving the stability of the *Flying-fish* to have been greater than that of the *Espiègle*, I can only repeat that its results were unfavourable to the latter; and the only method of forming a conclusion, being against Captain F.—he has failed to prove the advantages in the form of his favourite vessel, which he is so anxious to persuade your readers that she possesses.

Captain Fishbourne next discharges his ink bottle at the *Pantaloon*,—a vessel whose merits were so clearly proved, and so universally admitted in 1831, that a whole fleet sprang into existence from her lines. That she was not undeserving of the high opinion entertained of her, is sufficiently proved by her services during fifteen years; and there are many who have sailed from Falmouth in her numerous sisters, who have left their homes for North America in the winter season, with more hope of a return than they were wont to do when the old brigs (so justly named "coffins,") were employed to carry the mails. How many have been saved from a watery grave, by the judicious adoption of the *Pantaloon's* form, in that voyage alone, it is impossible to say; these are not the days for gratitude; but he who has long and successfully worked for his country's good may cherish this pleasing reflection, that posterity will award what contemporaries have striven to withhold.

But I have strayed from the subject, which was the stability of the *Pantaloon*. After ten years' active service the *Pantaloon* had a thorough repair, in which she was so altered that even her constructor did not know her; heavy wood was put in her upper works; she had passed through many hands; her stowage was altered, ballast was removed, and she was no longer like the same vessel.

I cannot express the disgust I felt in observing how she had been ruined. It is well known, that, in her palmy days, she had outcarried the *Barham*, and carried sail with the *Asia*. Previous to the last experimental cruise, her commander applied for more ballast, which was not stowed, but placed, I believe, either on the tanks, or as low as possible, without moving them. Under these disadvantages, the *Pantaloon* started; she was not permitted to fill her tanks, (that being a part of the experiment,) and she necessarily became "crank." What advantages were gained by this experiment, I do not know: but I maintain, that the *Pantaloon* became "crank," under circumstances, that she had the immediate means of remedying, and it is therefore hardly fair in Captain Fishbourne to condemn a vessel which might at once have restored her stability by filling her tanks; and which had always proved ready and able to keep the sea in the heaviest weather. Had Captain F. ever served in one of the surveyor's vessels, he would better understand their merits; but if I am not mistaken, his experience is confined to a voyage of a few days as a passenger in the *Dolphin*.

As I have been at no pains to inform myself respecting the construction of the *Flying-fish*, and confine myself simply to those practical points in which *experience* enables me to contradict opinions and statements generated and embodied by the fireside, I pass, in silence, Captain F.'s remarks on that subject

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and proceed to request your readers to examine the respective midship sections of the *Flying-fish* and *Espiègle*, and to judge for themselves which vessel can stow her tanks lower; for greater stowage of provisions depends as much upon that, as upon the height of the lower deck above the keelson. It will readily be seen, that the hollow lines of the *Espiègle* are very unfavourable for stowage.

We next come to the trial on the 14th of March, 1845, on which occasion, I remarked that the *Flying-fish* had shown greater power of carrying sail against a head sea than the *Espiègle*, and that the latter was evidently much overpressed. I also remarked, that both brigs stood up well, under as much sail as the masts would bear; it would not be difficult to show that these statements form no contradiction to each other, and are in perfect accordance with the facts which follow.

The *Espiègle* was exactly holding her position on the quarter of the *Flying-fish*, 66 yards to windward of her, when the latter set the main top-gallant sail; the *Espiègle* long hesitated to do so; but finding that she dropped without it, it was set; from that moment, a marked difference was apparent in her, she frequently dipped her jibboom completely under water; and a minute before it was carried away, an officer who was watching her remarked, "such another plunge and her jibboom is gone;" the next pitch verified his words. The loss of the jibboom is attributed to "a squall." Now if this squall reached the *Espiègle* at 12^h. 30^m., and the wind's velocity was 20 miles an hour, the *Flying-fish* would have felt it just seven seconds later; which proves the absurdity of the argument, that the *Flying-fish* would have fared the same had she been where the *Espiègle* was. Captain F. facetiously remarks: "Here we see the cause of her (the *Espiègle*) plunging—'the squall,' which would have happened to the *Flying-fish* if she had been to windward, or, on this occasion, if Captain Harris had not taken in her jib before 'the squall' struck her."

How important were these seven intervening seconds!!! and what became of "the squall?"—Did it reach the *Flying-fish*, or was its mad career suddenly arrested after it had robbed the matchless *Espiègle* of the victory to which (according to her captain's report) she was hastening? Alas! the careless log-book of the *Flying-fish* has failed to record it! Nor has it mentioned that the *Flying-fish's* jib was taken in "before the squall struck her," as Captain Fishbourne, regardless of recorded facts, and without a shadow of foundation, has asserted! And here Captain F. will find no difficulty in keeping me to my statement, from which he assumes I have departed. These two brigs stood up well under as much sail as the masts would bear; but had the pitching motion of the *Espiègle* been as easy as that of the *Flying-fish*, her jibboom would not have felt "*the squall*," and the termination of that trial would have left more satisfactory evidence as to which vessel was superior, than the bare assertion that the *Espiègle* was "weathering fast upon the *Flying-fish*." Had the commander of the *Espiègle* been aware of the great advantage gained by the *Flying-fish* on a similar unfortunate occasion, (which is quoted by Captain F.,) in which it appears that she did much better with her jib, inner jib, flying jib, and their respective booms towing under her bows for twenty minutes, he would not have neglected so good an opportunity of improving the sailing of his vessel.

Captain Fishbourne next wishes to quote the *rejected* pendulum in support of his own assertions; but if this instrument is not to be depended upon, a mean of many days which I have quoted is more likely to be true than the record of a single day, which brings his argument (respecting the *Espiègle's* stability on the 14th March) to the ground; and I would appeal to his candour, whether a vessel may not show other symptoms of being overpressed with sail, without her lateral inclination being very great,—such, for instance, as dipping her jibboom under water?

With reference to the waist anchors of the *Flying-fish*, they were stowed in Portsmouth basin in May or June, several months before the first cruise, and were never *shifted farther aft;* their situation was regulated by the position of the guns and of the foresheet, and proved most judicious. The insinuation that they were shifted aft on account of her pitching, is only another instance in proof that Captain Fishbourne has been the dupe

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of others; for I have too much respect for him to suppose that he would have coined such a statement himself.

In comparing studding-sail booms broken in the *Flying-fish* with jibbooms carried away in the *Espiègle*, Captain Fishbourne only renders his argument ridiculous. It must be a very uneasy ship that pitches away her studding-sail booms; but when the *Espiègle* constantly returned to port with her jibbooms sprung—when she staves her bowsprit and rakes her masts—it does not require a philosopher to discover her weak point. On returning from the first cruise, the *Flying-fish*, on the contrary, brought her masts upright—a sufficient proof that *pitching* was not her failing.

Your naval readers, sir, will now readily understand why Captain Fishbourne has received, as authentic, any malicious report that might place the *Espiègle's* rival in the same unfortunate position as herself with regard to pitching, as a drowning man grasps at a straw.

In Captain Fishbourne's lectures, he stated that the *Flying-fish* had a new gang of lower rigging before going to the coast; he has since endeavoured to qualify this assertion—but it seems in place to remark that she had *not* a new gang of rigging, nor did it require to be surveyed. But the case was very different with the *Espiègle*, whose rigging was so long-jawed, that it was for some time undecided whether she should have a new "gang." She kept her old rigging; but it was all "served" afresh.

It is scarcely necessary to say anything more upon the relative speed of the two brigs. I claimed in the report no victory for the *Flying-fish*, though the trials, as they terminated, gave her a numerical advantage; but I stated what I believe to be strictly correct,—that either brig might have an advantage dependent upon the nature and direction of the sea on the day of trial; but no one, with the returns before them, can, with any degree of justice or truth, claim an advantage for the *Espiègle*, though they *may* do so for the *Flying-fish*.

Captain Fishbourne has again misquoted my words relating to a table of requisites for a man-of-war, which were, "*If* this should not be considered an improper manner of combining the merits of these three beautiful brigs, they must, in future, be classed as follows:

"*Flying-fish*	1
"*Daring*	2
"*Espiègle*	3."

If Captain Fishbourne will again refer to my letter, he will find that the table refers only to the first experimental cruise, and can therefore form no contradiction to my report, which related to the last cruise.

An inconsistency next occurs in Capt. Fishbourne's letter, which I am compelled to notice. I observed that the distance gained to windward *on one occasion*, when the sea was nearly abeam, was in a ratio as the draught of water (of the respective brigs) was greater. This was *a remark* from which a deduction might afterwards be made;—the cause *might be* draught of water; there was, at any rate, a coincidence; but it is unworthy of a scientific man to adopt a mere remark as an assertion, or to found a law upon a single observation. Captain F.'s ostentatious display of "*cause*" and "*effect*," which so often occur in his writings, will now receive their full value from your readers. But I have not quite done with this paragraph. If Captain F.'s "cause and effect" held good in all the trials, because it did so in one trial, viz. that draught of water gave the advantage, the *Espiègle* would, according to his own showing, be again classed as No. 3; for he has before endeavoured to prove that the *Espiègle*, during the last cruise, drew half-an-inch less water than the *Flying-fish*. But in following the orbit of Captain F.'s arguments, I have left the straight line which I desire to move in.

Captain Fishbourne next says, "It must be borne in mind that when this result was obtained, the *Espiègle* was carrying six weeks' more provisions than the *Flying-fish*;" to which I may honestly reply, that if the latter could, *at that time*, have stowed six weeks more provisions, I would most gladly have taken them on board, to meet the nature of the trials, which were to be in heavy weather, under close reefed topsails and reefed courses.

I have next to notice another misstatement respecting the height of ports of the two brigs, which it is hardly necessary to reply to, as it will be remarked that Captain F., in his desire to sink the poor *Flying-fish*, brings her (in every page) deeper in the water; while the *Espiègle*, inflated, I imagine,

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with the constant puffing of her admirers, and others more deeply interested in her fame, rises, in like proportion, till her guns reach a most formidable height. But while Captain F. contradicts himself in every page, why should I be at the trouble to prove him in error? His last mistake in the respective height of ports of the two brigs is little less than a foot. The difference being, in fact, 3¾ inches, while he considers it as 1 ft. 2¼ ins.

In reply to Captain Fishbourne's observation, which accuses me of partiality towards the *Flying-fish*, I may refer him to my letters respecting the *Espiègle* during the period I commanded her; where he will find that I praised her good qualities, and attributed her doing so badly, on a wind, very much to bad helmsman; and one of her designers is well aware of the dissatisfaction I always felt on this point, when I had exerted every means in my power to beat the *Flying-fish*. On this point, at least, I felt secure from any attack; and in conclusion, I must add, that if all who had written about the *Flying-fish* and *Espiègle*, had confined themselves as strictly to facts, and acted towards the latter as impartially as I have done, she would hold a higher place in public opinion than she now does. Compelled by mis-statements, inaccuracies, and absurd theories, I had no alternative but to compare the two brigs; this comparison could not but be unfavourable to one of them.

Captain Fishbourne calls the *Flying-fish* my "much loved vessel," in which he is quite correct. I loved her as a seaman loves a vessel that he feels perfect confidence in—that he knows will carry him safely off a lee shore; that would place him quickly alongside an enemy; or show a light pair of heels when necessity required. I shall now, sir, conclude my letter by repeating, that I consider arguments of this nature so unprofitable to Her Majesty's service, that I shall not reply to any other statements that it may please Captain F. to make; and I trust he will again read dispassionately what I have written, with the same feelings towards himself that my last letter expressed.

Your obedient servant,

R. HARRIS, Commander.

Osborne-terrace, Southsea,
Nov. 24, 1846.

ON THE COMPRESSED-AIR LOCOMOTIVE.

Sir,—The conclusions at which I arrived in my last paper were based upon the consideration that Mariotte's law, (*i. e.*, that the pressure of air varies as its density,) holds good universally where the temperature is the same. This has been experimentally proved to be the case, for all practical purposes, by Faraday in England, and Arago, Dulong, Thilorier, and others, in France.* The temperature, however, does not remain the same, but varies considerably at different densities, unless the change of density is produced slowly; but the law according to which it varies, *when the change of density is considerable*, has not, as far as I know, been determined, nor indeed have the temperatures themselves been ascertained by experiment. For small and very rapid changes of density, the changes of temperature may be determined from the following equation:

$$\frac{1+\cdot00208\times t'}{1+\cdot00208\times t}=\left(\frac{d'}{d}\right)^{0\cdot416}$$

where t', t, d', d, are the corresponding temperatures (in degrees, above 32 according to Fahrenheit,) and densities respectively,—that is to say, when by mechanical means the density of air is suddenly changed from d to d' the temperature changes from $32°+t$ degrees to $32°+t'$ degrees.

For the corresponding pressures the formula is,—

$$\frac{P'}{P}=\left(\frac{d'}{d}\right)^{1\cdot416}$$

where P', P, d', d, are the pressures and densities when heat is taken into consideration. I will apply these equations to the example before us. Let air of the density of 50 atmospheres of the surrounding temperature, and therefore of 50 atmospheric pressures, occupying a space one foot high, expand, until it is of one atmospheric pressure. Let us see what its density will be. By substituting 1 for P', 50 for P, and 50 for d, we get

$$d'=50^{\frac{416}{1416}}=3\cdot17 \text{ about;}$$

and as at a density 1 it fills a space 50 feet high, at a density 3·17 it will fill a

* Vide "Annales de Chimie et de Physique," 3rd Series, vol. v., p. 83; also, Pouillet's "Physique Expérimentale," vol i., p. 141.

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space $\frac{50}{3 \cdot 17}$ or, 15·8 feet high nearly.

Again, let it expand until it is of 5 atmospheric pressures. Then we have

$$\frac{5}{50} = \left(\frac{d'}{50}\right)^{1 \cdot 416}$$

$\therefore d' \times 10^{\frac{1}{1 \cdot 416}} = 50$, or $d' = 9 \cdot 9$ about;

and it will occupy a space $\frac{50}{9 \cdot 9} = 5 \cdot 05$ ft. high.

Therefore it would, at a rough calculation, be exerting pressures through $(15 \cdot 8 - 5 \cdot 05) = 10\frac{3}{4}$ feet that by the former calculation it would be exerting through 40 feet, or we should get little more than a quarter of the work that we calculated without considering the cooling by expansion. But as I remarked above, these formulæ for determining the heat and pressures at different densities are only true when the change of density is very small, and very rapid; indeed, they are drawn from experiments upon sound, where by the hypothesis the disturbance which causes sound, and the resulting change of density, are very small;* but with regard to changes of density of any magnitude, it is by no means true, as the experiments of the Baron von Rathen have clearly shown him. But even were they true, it does not materially affect the question, as, although the cooling upon expansion (which is the cause of the extra decrease of pressure) would be inconceivably great (Pouillet, Phys. Exp., vol. i., page 285,) when expressed in degrees of the thermometric scale, yet we must observe that, as the heat originally existed in the air of the common density and temperature before it was compressed, so it may very easily be re-obtained from the surrounding air, if the air in the moderator, and in the tubes leading to it, be well and freely exposed to the atmosphere. This is proposed to be effected by passing small copper tubing, open to the external air, through the moderator and the passages leading to it, and the rapid passage of the locomotive through the air will greatly increase the warming effect; and when the air gets into the cylinders, the extra heat of the piston-rods will no doubt restore its original heat, and enable it to do its full amount of work. Keeping in view, however, the losses which might occur from these causes, I have taken the friction of the locomotive at $\frac{1}{4}$, instead of $\frac{1}{5}$, $\frac{1}{6}$, or $\frac{1}{7}$, which I should otherwise have done. There is, of course, a corresponding loss of power, from the manifestation of heat in condensing the air; this, however, will be found to be very trifling when I come to describe the system of condensing pumps and the method of filling the locomotive, which indeed constitute the *sine quâ non* of the invention, and involve a very interesting and scientific series of arrangements. However, I have there also taken the loss of power at $\frac{1}{4}$ instead of the smaller fractions which I might have done. It is quite impossible to allow for all these things with any accuracy, but I do not think that I am far from the truth. Another point with regard to the effect of heat is the change of bulk, and consequently of the pressure of the air in the locomotive reservoir, which will arise from external changes of temperature. This we can estimate with sufficient accuracy. (See, however, Pouillet, vol. i. p. 285.) As the difference of the external temperature cannot, under any circumstances, be greater than that between 32° and 100°, we will take it to be 70°. Now, for this increase of heat air expands from 100 to 114, and therefore the pressure of air of 50 atmospheres increases from 50 × 15 to 57 × 15 pounds on the square inch, which, as the reservoirs are calculated to bear a much greater pressure, is of no consequence.

Upon the whole, then, we may conclude that with 34 times as much compressed air of 50 atmospheres in the air locomotive, as of water in the steam locomotive, we should do the same work, if *both machines were worked in a similar manner and the steam locomotive had no peculiar losses.* This, however, is not the case. What these causes of loss are it is not my province to determine, but the rapid cooling by radiation; the not being able to work the steam expansively to the full effect, that is, not cutting off the steam so that the cylinders are filled with steam of the common density merely—the contracted passages which prevent the steam in the cylinders from being of the same density as that in the boiler, &c.—may be mentioned among the probable causes.

The surest way, however, is to see

* See, however, upon this subject, the experiments of MM. Clement and Desormes. (*Encyclopædia Metropolitana*, Art. "Sound," section 76.)

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what the steam locomotive does, and what it ought to do theoretically. We have before seen that the steam of 77 cubic feet of water worked at 5 atmospheres, and expansively, ought to raise $15 \times 144 \times 1700 \times 77 \times 1{\cdot}6$lbs. 1 foot high. We have the fact, that it does in a locomotive propel 40 tons through 35 miles. Now the work of propelling a certain weight on a railway has been variously estimated, as equivalent to raising through the same distance $\frac{1}{150}$, $\frac{1}{200}$, $\frac{1}{250}$ or $\frac{1}{300}$ of the weight. The experiments from which these conclusions are drawn seem to have been very rough and inconclusive; but as we reason backwards upon exactly the same principles as those upon which they are founded, we may fairly take $\frac{1}{200}$ as the mean of these results.

Therefore 77 cubic feet of water evaporated in a locomotive do work equivalent to raising $\frac{49}{200}$ tons through 35 miles, or $7 \times 20 \times 112 \times 1760 \times 3$ lbs. through one foot.

$$\therefore \frac{\text{Work actually done by 77 feet of water}}{\text{Work theoretically due to it}} = \frac{7 \times 20 \times 112 \times 1760 \times 3}{15 \times 144 \times 1700 \times 77 \times 1{\cdot}6} = \frac{2}{11} \text{ about.}$$

While with 34×77 cubic feet of air at 50 atmospheres, this proportion is $\frac{3}{4}$; therefore the work that we can do with 77 cubic feet of water, we can do with $\frac{4}{3} \times \frac{2}{11} \times 77 \times 34$, or $4 \times 8 \times 20$ feet of air about; so that a reservoir 4 feet wide, 8 feet high, and 20 feet long would be sufficient. Now let us see what quantity of water must be evaporated in a stationary low-pressure engine to obtain this quantity of compressed air.

Since $15 \times 144 \times 4 \times 8 \times 20\,(50 \log._{\epsilon} 50 - 49)$ is the theoretical power required to obtain it, if we multiply this by $\frac{4}{3}$ in order to allow for the friction of the condensing pumps, and again by $\frac{4}{3}$ for the friction of the steam-engine, we shall have, if W be the quantity of water necessary to be evaporated,

$$15 \times 144 \times 1700 \times W = 15 \times 144 \times 4 \times 8 \times 20 \times (146{\cdot}6) \times \frac{16}{9};$$
$$\text{or } W = 99 \text{ about.}$$

Therefore 99 feet of water evaporated in a stationary low-pressure engine will enable us to obtain 640 feet of air of 50 atmospheres, which worked expansively at 5 atmospheres will do as much work as 77 cubic feet of water evaporated in a steam locomotive. In this calculation I have assumed, that the work done by the steam locomotive in question is the average performance of these machines, and I find that, upon looking over that of several others, it is above the average. I have assumed that the weight raised is $\frac{1}{200}$ of the weight drawn; that the friction (in which term I of course include all that is to be subtracted from the theoretical efficient work of a machine) in each of the three machines is $\frac{1}{4}$: and I have proved that, were there no loss of heat upon expansion, the loss by the "moderator" would, in the case before us, be about $\frac{1}{5}$. I do not at all maintain these assumptions to be correct; your readers will substitute for them as they see fit. With regard to the question of heat, the Baron von Rathen considers that he will not only avoid loss, but will gain by various arrangements for compressing the air at a very low temperature, and for heating it during its expansion. However, to be quite on the safe side, let us suppose the quantity of water necessary to be evaporated in the stationary engine instead of 99 to be 154 cubical feet, or twice as much as the steam locomotive consumes. Though we cannot calculate with any accuracy, we may still very easily see the causes from which the gains upon the compressed air system are expected. Firstly, by comparing the two locomotives we see—that the air is never used except beneficially; that it may be turned off or on, its density increased or diminished at any moment; while the steam is now of an unnecessarily high, now of an insufficient pressure, and again blown off because it is not wanted, while the fuel is still being consumed. But I need not go on to mention the numerous advantages which the one power, always ready and under control, has over the other; the difficulty and expense of constructing the one machine, as compared with the other; the destructive nature of the fire—a perfectly extra cause of repairs and renewals; the dangerous and disagreeable qualities of steam, smoke, coke-dust, &c., in the one case; the greater adaptability to receive improvements regarded merely as a locomotive, —and the less laborious and more simple

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work of fewer attendants in the other; all these are sufficiently obvious. Secondly, by considering the much cheaper way in which the source of power in both cases, steam, may be generated in a stationary engine, as a cheaper fuel is consumed, and in a slower and better regulated manner, and with more perfect combustion, as the steam may be constantly employed in storing up power, while in the locomotive great loss of fuel takes place in getting up the steam, and of heat in putting out the fire by letting the coke fall into water; as we are enabled to take advantage of all the numerous inventions for utilising the heat, and for which also the Baron von Rathen has two separate inventions proved to be highly successful; and as a much diminished loss of heat by radiation, and through the chimneys, is incurred by employing, and an inferior expense in constructing, one large engine always at work, instead of several smaller ones;—all these considerations lead me to conclude that 200 cubic feet of water may be evaporated in a stationary engine, at half the expense of fuel that 100 can in a locomotive, and we shall then have to add to the advantages of the air-locomotive the diminished expenses for attendance and repairs. All this, too, without any increase in the original outlay. Upon this point I shall quote from the Baron's circular: "It is stated in evidence that the stock of locomotives on the London and Birmingham Line is about ninety, and that they cost about 1500*l.* each, in all, therefore, 135,000*l.* The inventor estimates that about twelve magazine stations would be required, upon his system, on that line; and that the cost of each, including stationary engine, compressing apparatus, magazine, and sheds, would be *under* 3000*l.*; in all, therefore, about 35,000*l.*; the remaining 100,000*l.* he calculates would supply 100 air-locomotives of different powers, with the requisite auxiliary magazine wagons for heavy trains." I think, therefore, that I may fairly say, that the subject is well worth the attentive consideration of some abler person than myself. I had almost forgotten to refer to the weight of the air-reservoir upon the locomotive. The reservoir, though spoken of in the singular, is not, indeed, one chamber, but a number of cylindrical vessels 5 feet long, 9 inches in diameter, and one-eighth of an inch thick, connected together by pipes, and disposed about the locomotive in the most convenient places. Now I find from the select tables in Professor Moseley's *Mechanical Principles of Engineering*, that "iron rolled in sheets, and cut crosswise", will sustain 18 tons on the square inch. The formula for ascertaining the pressure per square inch, that a cylindrical vessel will bear, is

$$\text{Pressure per square inch} = \frac{\text{thickness of vessel}}{\text{radius of cylinder}} \times \begin{array}{l}\text{weight per square inch}\\ \text{the metal will support.}\end{array}$$

Therefore substituting $4\frac{1}{2}$ inches for the radius, 18 tons for the weight, and one-eighth of an inch for the thickness, we get

$$\text{Press. per square inch } \frac{18 \times 20 \times 112}{36} \text{ lbs.}$$

$$= \frac{18 \times 20 = 112}{36 \times 15} = 75 \text{ atmospheric pressures nearly.}$$

Therefore as it is proposed to submit them to 49 atmospheric pressures only, which by external heat may reach to 56, they will be quite strong enough. Vessels of this thickness and size have, however, been proved to be capable of sustaining much greater pressures than this. In *Poucelet's Mécanique Industrielle*, vol. i., p. 216, is given a table of strength of materials, where the strength of rolled sheet iron is stated to be about 26 tons to the square inch, or more than half as much again as that given above. As we increase the diameter of the vessels and diminish their number, the thickness, of course, increases as the diameter, and therefore the weight will remain the same; but iron of a much greater tenacity and soundness may be ensured by using the thinner vessels. Now a vessel of the kind here referred to contains about 2 cubic feet, and has a surface of about 11 square feet, which, according to the tables, will weigh under 56lbs.; however, taking the weight of the connecting tubes into consideration, we may say that one cubic foot of air of 50 atmospheres may be contained in a vessel weighing 28lbs.,

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and ∴ 4 × 8 × 20 cubic feet are contained in reservoirs weighing 8 tons; the weight of the air will be $3\frac{1}{2}$lbs. per cubic foot weighed in the atmosphere, and therefore the weight of 4 × 8 × 20 cubic feet will be 1 ton. Therefore, upon the whole, the weight of that which in the air-locomotive corresponds to the furnace, boiler, tender, water, &c., in a steam-locomotive evaporating 77 cubic feet of water, will be 9 tons. If you are not already tired of the subject, I will conclude my remarks next week by describing what I consider by far the most important part of the invention, viz., the compressing, retaining, and transmitting apparatus of the Baron von Rathen. My remarks hitherto have been nearly equally applicable to Mr. Parsey also; but as the patent of the former is of a date some four years anterior to that of Mr. Parsey, and as the invention of the latter is merely the moderator, while that of the former contains, in addition to this, "*arrangements for a complete system* of compressed air-locomotion in all its branches, I have preferred alluding to him only.

I am, Sir, &c.,

x^2.

LIEUTENANT MOOR'S PLAN OF FIRING SHELLS BY ELECTRICITY.

Sir,—The letter from Lieut. Moor, U.S. Navy, to President Polk, inserted in your Magazine (No. 1215, p. 487,) appears to have been penned by a gentleman, who, if there is any truth in phrenology, should have the organ of self-esteem most fully developed, and a the same time I opine that his warlike experience has been scanty indeed, or he would not have stated that his idea was so *very happy*. His plan perhaps might be used under some circumstances with advantage; but it is quite ridiculous to suppose it has the superiority over the common methods which the writer states. He speaks as if it was something very extraordinary that his shell can be traced by the eye during its flight, when projected by the very small charge of powder, only sufficient to send it 2,000 feet. A shell can *always* be seen, by night (from the light of the fuze) or by day. I have seen hundreds, particularly some thrown into Cadiz during the siege by the French, and have often stepped aside to let them pass without obstruction from me, like a well-mannered man as I was! These visitors came from mortars cast for the special purpose; one was sent to England, and was somewhat facetiously termed, the Prince Regent's *bomb*, when first placed in St. James's Park. He says, "Another consideration of equal importance is, that the electric shell is projected with so moderate a velocity that it can be distinctly traced by the eye," &c. There can be nothing in his electric shell that enables it to be projected with a moderate velocity any more than a common shell, weight for weight, and distance for distance; and although all shells can be very well seen during their flight, still he would not find it easy to make his connection, to explode his shell at the exact time it was over the enemy's ship or battery, for the manipulator stands in a line with the path of the shell, and from this point of sight, whether it is 1000 or 1500 feet from the mortar, or 500 feet short or beyond the object fired at, it would be impossible to tell. But supposing this difficulty got over, the effects to be produced are absurd, beyond anything I ever read or heard of, except one or two *real facts*, that *did* occur to Baron Munchausen. When Lieut. Moor wrote this letter, he must have supposed that a shell never had been exploded at the proper time and place; for if there ever had been an occurrence of the sort, the effects must have been such that they would have occupied a conspicuous place in history; why not, as well as an *earthquake?* Just fancy what ONE of these shells would have done at Antwerp—"in its passage over a fortification, have entirely dismantled it, or swept down whole ranks in its passage over any force opposed to it, or, if on the water, it would have destroyed an enemy's ship, set fire to the shipping in the harbour, and annihilated everything that was perishable at any point of its passage."

In another passage he likewise describes the advantages to be gained over batteries and first-class ships,—I suppose first-rates are meant,—but if he has ever seen much of either, one or the other, he made bad use of his eyes, or he would not have stated that they have no defences from the effects of a shell. Granting that the explosion of a shell over a first-rate would do considerable damage

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upon the upper deck, there would be still three more decks that would certainly be pretty well protected. As to batteries, has he never heard of bomb-proof fortifications? Has he ever seen the batteries at the mouth of Portsmouth harbour, or on the rock of Gibraltar, or the fortifications at hundreds of other places?

It is not necessary for the shells in present use to strike the object in order to produce its effects; they are *generally* caused to explode while passing over the object to be injured, but still they do not "immediately make any fortress untenable," neither do they prevent the largest fleets approaching them without "being instantly destroyed," or "destroy and set fire to everything in their vicinity." In fact, shells are not capable of setting fire to anything unless in the *immediate* vicinity of their explosion, being only charged with gunpowder. Rockets are used for this purpose. When shells explode, it is the fragments that do the mischief, and, as the electric is not pretended to have any advantage over the common shell, except the supposed one of regulating its explosion, I think that Lieut. Moor will, upon re-consideration, think that his "happy idea" is not "of more importance than anything that has taken place since the discovery of gunpowder."

I have gone on thus far with the gallant officer, supposing his opponents to be perfectly quiescent, which in practice would *probably* not be the case. There have been many excellent plans for blowing ships out of the water, destroying fleets, &c., and I believe the only real obstacle to success was that the people on board them would not consent, but interrupted the projectors, and threw so many difficulties in their way, that it was impossible to succeed. As Lieut. Moor's government are just now at war with a people who are as little likely as any nation to throw obstacles in his way, and they moreover hold a place called "San Juan de Ulloa," which his countrymen are very anxious to get, I recommend him to volunteer his scientific services to make the transfer; the expense would be trifling,—only an old merchant ship, armed with a 24-inch mortar, a few *ounces* of powder, and say 50 or 60 shells.

I am, Sir, &c.,

An old subscriber,

T. W.

RETROSPECT OF THE PROGRESS OF STEAM NAVIGATION.

[From the Address of Sir John Rennie, President of the Institution of Civil Engineers to the last Annual General Meeting.]

The origin of the application of steam for propelling vessels is claimed by several individuals of different nations; but it is generally admitted that to Great Britain is due the merit of having introduced and established the successful practice of the present age. The application of wheels to propel boats dates as far back as the Romans; in 1682, Prince Rupert's barge was propelled in a similar manner, and tug vessels, with wheels worked by horses, for towing vessels against wind and tide, were proposed. Papin proposed, in 1690, to propel boats by racks and pinions with pistons working in steam cylinders. Blasco de Garay, a Spaniard, is said to have made an experiment on propelling a vessel in the presence of the Emperor Charles V., at Barcelona, in 1543. The experiment is reported to have succeeded, and received the approbation of the emperor, who paid all the expenses. The invention, if it existed, died with the inventor, and nothing further was heard of it, until after the introduction of steam navigation, when the statement was made in order to claim for Spain the merit of this great invention. Had this claim been brought forward earlier, and published to the world, it perhaps might have been allowed; but appearing at this time, it could have no influence, and must clearly be regarded as in no way interfering with the title of Great Britain to the discovery. Jonathan Hulls, in 1737, published a small pamphlet, wherein he gives a plate representing a boat with a wheel attached to the stern, driven by a steam engine to propel the boat, and tugging behind her a vessel of war. This is clearly the first representation on record of a steamboat. He took out a patent for the invention; but experienced so much opposition from prejudice, that he does not appear to have prosecuted it afterwards. Hulls proposed to apply Newcomen's engine for propelling the wheel, but as it was very difficult to produce rotary motion with that kind of engine, that may have been one reason why it was abandoned. Savery proposed, in 1698, to apply manual power to the capstan of a ship, by the intervention of a wheel and pinion for turning paddle-wheels attached to the sides of the vessel; and, at a later period, Captain Burton proposed a similar plan. All idea, however, of bringing the invention to bear appears to have been laid aside until 1765, when the mechanical and scientific world had again

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turned their attention towards the improvement of the steam-engine, and Dr. Robison, of Edinburgh, proposed to Watt to apply steam for propelling vessels on land and by sea. Watt, however, at that time had not made sufficient progress with his invention, to enable him to take up and work out the idea with sufficient prospect of success, as it is evident, that he could not have considered Newcomen's engine at all calculated for the purpose; Watt, therefore, confined his views to perfecting his engine, foreseeing, no doubt, that when once that end was accomplished, other important results would follow.

The subject of steam-boats still lay dormant for a time. In 1782, the Marquis de Jouffroi is said to have made a steam-boat, 140 feet long and 15 feet wide, which was tried on the Saone at Lyons, but it was not successful. About the year 1787, Watt had so far perfected his steam-engine, and rendered it capable of producing rotary motion, as to enable it to turn mills: he had thus overcome one of the principal difficulties, and prepared the way for the introduction of the modern system of steam navigation; but although numerous attempts were made with imperfect engines for propelling vessels, even after Watt had obtained patents for his improved engines, yet it was not until after the expiration of his patent for the rotary engine, in 1800, that it was applied to steam-vessels.

About the year 1788, Fitch and Ramsey, of America, and Serrati, of Italy, appear to have tried some experiments, and thus they lay claim to the invention, but upon this point there is no accurate information. In the same year, Miller, of Dalswinton, constructed a double boat, 60 feet long, with two paddle-wheels in the centre, to be moved by manual labour, in order to race with another boat propelled by oars in the usual manner; it was tried upon the sea near Leith, when Miller beat his competitor, and the effect of this experiment convinced him, that power only was wanting to bring the invention to perfection. Taylor proposed to apply the steam-engine for this purpose, and he then applied to Symington, a practical engineer of the day (who had previously proposed some improvements in Newcomen's engine, and had made a model showing how it might be applied for the purpose of propelling carriages,) in order to assist him in applying the steam-engine for working paddle-wheels. A steam-engine with two cylinders, 4 inches in diameter, each of about one-horse power, was accordingly made by Symington and Taylor, and was applied to drive the paddle-wheels in the centre of the double boat, employed for pleasure on Dalswinton Lake, in the middle of October 1788, when it attained a velocity of about 3 miles an hour. The success of this experiment was complete as far as it went, and established beyond doubt the merits of the discovery; it therefore induced the ingenious and persevering projectors to prosecute it further by making another vessel of the same dimensions as the former one, to be worked by an engine upon a larger scale: the engine was made at Carron, and was of a peculiar construction, in order to avoid infringement on Watt's patent; it had two atmospheric cylinders of 18 inches diameter, the pistons of which were connected with a lever acting alternately and by means of chains; pulley-wheels and ratchets turned two paddle-wheels, one being placed before the other, in the space between the two parts of the double boat; this machinery, it will be observed, was similar to Hull's plan, improved, however, by having two cylinders. The boats and engines were completed, and the experiment was tried on the Forth and Clyde canal on the 26th December, 1789, and was still more successful than the first, having attained a velocity of 4 or 5 miles an hour. An account of this experiment was published in the Edinburgh newspapers of the day. The signal success of this second steam-boat, rendered further experiments unnecessary, and it now only remained to bring it into practical operation. Messrs. Miller, Symington, and Taylor had proved to the world, the merits of the discovery, and not wishing to incur further expense or trouble in combating the prejudices and opposition of mankind, which invariably obstruct the introduction and prosecution of every great invention, did not prosecute the subject further, but left it to others to work out and develope the powers of their extraordinary invention, which was destined, at no distant period, to produce such a wonderful revolution in the social world. The engines and machinery were accordingly taken out, and deposited at the Carron Works, and the boat, which was only a pleasure-boat, and fit for no other purpose, was transferred back to the lake of Dalswinton, and again applied to its original purpose. Mr. Miller returned to his agricultural pursuits; Taylor to his profession of a tutor; and Symington to his profession of a practical engineer.

In 1793, Ramsay made some experiments for propelling a vessel, by forcing water out of the stern by a steam-engine; this does not appear to have answered.

In 1795, Earl Stanhope, well known for his mechanical genius, tried an experiment for propelling a vessel, by means of a propeller in the form of a duck's foot; and

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about the same time Smith fitted a boat with an atmospheric engine on the Sankey Canal; none of these experiments, amidst several others which were tried, appear to have been very successful; the great difficulty seems to have been, in producing the rotary motion by the steam-engine employed for the purpose, and it is singular that none of them tried Watt's engine, which had then become generally known, and Boulton and Watt themselves were too busy in making their engines for the numerous mills and waterworks then becoming daily more general, to turn their attention to fresh speculations, the issue of which was at that time doubtful, and which did not promise to be so lucrative.

In 1801, Lord Dundas, who took great interest in mechanical pursuits, employed Symington to construct a steam-boat; this was propelled by an engine on Watt's plan, having one cylinder placed horizontally, and the piston, with a stroke of 4 feet in length, was jointed at the extremity, and attached to a connecting rod, with a crank at one end, turning a paddle-wheel, placed in a well-hole at the stern of the vessel, which had two rudders, one on each side of the cavity in which the paddle-wheel was placed. This was the first practical working steam-vessel, with an engine on Watt's system, and was called the *Charlotte Dundas;* it was employed for towing vessels on the Forth and Clyde canal, and answered its purpose completely, but the proprietors of the canal objected to its being continued, in consequence of the agitation of the water produced by the paddle-wheels, which they alleged would injure the banks of the canal. In 1802, Fulton, who had been sometime in England, hearing of Symington's attempts, went to Scotland, visited him on board his boat, and requested to see it tried. Symington accordingly got up the steam, made several trips up and down the canal, and fully explained to Fulton every part of the boat, steam-engine, and apparatus. Fulton made notes of everything, observing at the same time, that the objection of injuring the banks of the canals and small rivers might apply in England, but that in America, where they were upon a much larger scale, this inconvenience could not be felt, and he thought the application of steam-boats in that country would be of immense public and private advantage, and stated his intention of introducing them there. After this visit to Symington, Fulton proceeded to France, where he constructed his first steam-boat, and tried it on the Seine, at Paris, in 1803, and proceeded to America soon afterwards. It is rather singular that Napoleon, who was then First Consul and who usually was alive to all great improvements, and carried them through with a degree of energy and talent which overcame all opposition, should not have appreciated the merits of the steam-boat, and should have allowed such a fine opportunity of benefiting France to have slipped through his hands; but perhaps the same may be said of England, as being still more extraordinary, for the advantages of the steam-engine and machinery had then become universally acknowledged. Fulton, however, impressed with the importance of the invention, and being thoroughly convinced of its ultimate success, pursued it with unremitting perseverance and energy, and in 1805 he applied to Messrs. Boulton and Watt to make a steam-engine for a boat which he was about to construct in America; this boat was accordingly built in 1807. Watt's steam-engine reached America in 1806. The vessel was named *The Cleremont,* from his friend Livingtone's residence; the wheels and machinery were on Symington's plan, propelled by Watt's engine; the boat was tried on the Hudson River, and only attained a speed of five miles per hour. This was the first steam-boat used in America, and Fulton and Livingstone then took out patents for introducing steam-boats in various places in America, and built several others, upon a larger scale, for carrying goods and passengers, employing Messrs. Boulton and Watt to make the steam-engines, which were sent from England, each succeeding engine being larger than its predecessor. Although it was generally known that the steam-boats had succeeded perfectly in America, and that their employment was daily increasing, yet little or no attention was paid to the subject in England. The idea of employing steam-boats on the ocean had never been conceived, and the objections raised to the agitation of the water by the paddle-wheels on the Forth and Clyde canal, were considered so strong, that doubts were generally entertained as to the success of the system anywhere but in large rivers, such as those of America. In 1812, however, Henry Bell, of Glasgow, who was well acquainted with, and had deeply considered all that had been done by Symington, determined to try once more whether the invention could not be applied on the Clyde; he accordingly caused a small boat of 25 tons burthen to be built at Port Glasgow, by John Wood, who has since become so well known as a ship-builder; it was 40 ft. long, with 10 ft. beam, and in it was placed a steam-engine of 4 horses power, on what was termed the bell-crank principle, introduced by Watt; the boiler was placed on one side of the vessel and the engine on the

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other with four paddle-wheels worked by the intervention of spur gear; the wheels consisted of detached arms, with paddles or floats at the end, which, however, did not answer, and the complete wheel, according to Symington's plan, was subsequently adopted. This boat, which was called the *Comet*, began to ply for goods and passengers on the Clyde, between Glasgow and Helensburgh, (Bell's native place,) in January, 1812, and attained the speed of five miles an hour.* The *Comet* succeeded so well, that Bell determined to build another vessel of larger dimensions and power. Numerous other parties, seeing the success which had attended Bell's exertions, determined to follow his example, and several other boats were built during the succeeding years of 1813 and 1814; they were however still very imperfect, until Cook, of Glasgow, in 1814, constructed the fourth vessel, the *Glasgow*, with an engine of 16 horses power. The machinery of this vessel was so much more perfect and powerful than any which had been previously constructed, that it served as a model for many others; and from this period steam-boats for river navigation were completely established.

Many of the engines employed for the above-mentioned vessels were upon the bell-crank principle; which, from their simplicity and portability, standing upon an independent frame, with the condenser forming part of it, were well adapted for steam-boats, and were consequently generally used. The bell-crank levers receiving the motion direct from the piston, communicated it by means of a connecting rod and crank to the main shaft, turning the paddle-wheels on each side of the vessel; the engine was placed on one side of the vessel and the boiler on the other. The boilers generally used, were upon the principle proposed by Allen in 1730, and Smeaton in 1765, having an internal furnace and flue, surrounded by the water. This form of boiler was first brought into use by Trevithick in 1803, for high-pressure engines, and for low pressure engines, also, in one of the earliest steam-dredging boats employed at Portsmouth Dockyard, under Bentham; but the exterior shell of this boiler was of wood, as proposed by Brindley in 1758; in steam-vessels the external shell of the boiler was made of wrought iron. All the steam-vessels above mentioned were worked by one engine only. In 1814, Boulton and Watt first applied two engines, connected together, for working a small boat on the Clyde.

In 1815, a small vessel, with a side-lever engine of 14 horses power by Cook of Glasgow, made a voyage from Glasgow to Dublin, and round the Land's End to London; it then ran between London and Margate with passengers with considerable success, and this led to others being established in various places; the Scotch boat serving as a model.

In 1816, Maudslay made a pair of combined engines, each 14 horses power, applying the power to the paddle-wheel shaft by the crank, instead of by cog-wheels, according to the previous mode.

In the same year, the late Mr. Baird constructed a steam-boat at St. Petersburg, with a boiler set in brickwork; this boat worked for some time on the Neva; a drawing of it exists in the archives of our Institution.

In 1817, Boulton and Watt purchased a small steam-boat called the *Caledonia*, which had been built in the Clyde, with very defective engines. James Watt, jun., having constructed a new pair of combined engines

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* In the collection of the Institution of Civil Engineers is the following handbill:—

"STEAM PASSAGE BOAT, THE *COMET*,

"*Between Glasgow, Greenock, and Helensburgh, for Passengers only.*

"The subscriber, having at much expense fitted up a handsome vessel to ply upon the River Clyde, between Glasgow and Greenock—to sail by the power of wind, air, and steam, he intends that the vessel shall leave the Broomielaw on Tuesdays, Thursdays, and Saturdays, about mid-day, or at such hour thereafter as may answer from the state of the tide; and to leave Greenock on Mondays, Wednesdays, and Fridays, in the morning to suit the tide.

"The elegance, comfort, safety, and speed of this vessel require only to be proved to meet the approbation of the public; and the proprietor is determined to do everything in his power to merit public encouragement.

"The terms are, for the present, fixed at 4s. for the best cabin, and 3s. the second; but beyond these rates, nothing is to be allowed to servants, or any other person employed about the vessel.

"The subscriber continues his establishment at Helensburgh Baths the same as for years past, and a vessel will be in readiness to convey passengers in the *Comet* from Greenock to Helensburgh.

"Passengers by the *Comet* will receive information of the hours of sailing, by applying at Mr. Houston's office, Broomielaw; or Mr. Thomas Blackney's, East Quay Head, Greenock.

"HENRY BELL.

"*Helensburgh Baths, August* 5, 1812.*"

Mr. Bell presented this new method of navigation to the British Government at three different times, viz., in 1800, 1803, and 1813,* when, after all his exertions, it was thought to be of no utility to Government. After it was denied him in 1803, he thought it very hard that such a discovery should lie dormant; and, on that account, he sent a description of the method of applying steam in propelling vessels against wind and tide, to all the emperors and crowned heads in Europe, and also to America, which last government put it in practice in the year 1806.

* Thus in the original.

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on the side-lever principle, of 14 horses power each, made a great number of experiments with the *Caledonia*, and went with it to the Scheldt and other places; the arrangement of the engines, as improved by Watt, served as a model for several other vessels.

In 1818, David Napier caused the *Rob Roy*, of 90 tons burthen, to be built by Denny at Dumbarton, with an engine of 30 horses power, with which he successfully established a regular communication between Greenock and Belfast: this may be said to be the first time that a regular communication by steam-boats, between two distant sea-ports was established, and it set the example to every other place. Boulton and Watt, after the success of the *Caledonia*, made a great number of marine engines of increased power, and with various new improvements, such as introducing wrought iron instead of cast iron for several of the moving parts; and in 1821, a great step was made, by establishing steam-boats between London and Leith. Two of these vessels, the *James Watt* and the *Soho*, with engines of 120 horses power, by Boulton and Watt, were the largest which had been made, and answered very well.

In 1819, the *Rob Roy* left the Belfast station, and was transferred to the English Channel, to run between Dover and Calais. About this time Napier built the *Talbot* of 150 tons, with two engines of 30 horses power each, which ran regularly between Dublin and Holyhead. In this year also, the late Mr. Rennie, who had for some time previous watched the progress of this great invention with considerable interest, foreseeing that it would ultimately supersede all others, proposed to the Admiralty to use steam-vessels for towing vessels of war into and out of harbour against wind and tide; being perfectly satisfied, that if once it was introduced into the navy, it could not be long before steam-vessels of war would follow; great doubts, however, as to its success were entertained and expressed by many of the official subordinates. Lord Melville and Sir George Cockburn, however, overruled all objections, and as a first experiment, they consented to allow the *Hastings*, a 74 line-of-battle ship, to be towed from Woolwich by the *Eclipse*, a Margate steam-boat of 60 horses power. The *Eclipse*, however, proved too weak, and after towing the *Hastings* a few miles, it returned, and the *Hastings* went to Chatham with her sails alone; the experiment was thus not quite so successful as could have been desired; nevertheless Rennie still determined to persevere. Oliver Lang, the master-shipwright of Woolwich Dockyard, entered fully into Rennie's views, and warmly assisted by every means in his power the introduction of steam-vessels into the navy, contrary to the opinions of many of his superiors. At length the Admiralty, at their recommendation, ordered the *Comet* to be built according to the draft and plan, and under the superintendence, of Mr. Lang; she was 115 feet long and 21 feet wide, drawing 9 feet of water, and a pair of engines, of 40 horses power each, were ordered for her from Messrs. Boulton and Watt: this was the first steam-vessel in the navy, and it is still in use. By degrees several others were built.

In 1820 a steam tug was built by Manby, for Messrs. Smith, for the purpose of towing their barges upon the Humber; and in the same year, Maudslay and Field applied the expansive action of steam in the cylinder, which was a great improvement; also escape valves for the water, which might boil over into the cylinders. In that year also, steam-packets were introduced on the post-office station between Holyhead and Howth; and the *Britannia*, with oscillating engines, and several other steam-packets, were built by Manby for the Dover and Calais station.

In 1825, the General Steam Navigation Company was established by William Jolliffe, who built two of the largest vessels which had yet been tried, called the *George the Fourth*, and the *Duke of York*; they were between 500 and 600 tons burthen, and had engines of 130 horses power, furnished by Messrs. Jessop of the Butterley Iron Works: these two vessels were intended to establish a regular communication between London and Cadiz and London and St. Petersburg; they accordingly started in September, 1827, and answered extremely well, notwithstanding the heavy storms which they encountered in the Bay of Biscay and in the Baltic. The General Steam Navigation Company, considering the ideas of Jolliffe too extended, parted with the two vessels (which were afterwards purchased by the Government), and limited their views to the British Channel and the German Ocean. About this period, the *Enterprise*, of 500 tons burthen, which was built by Gordon, and had a pair of combined engines of 120 horses power, constructed by Maudslay and Field, made the voyage from London to Calcutta, by the Cape of Good Hope. The advantage and superiority of steam-vessels, in every respect, for both river and sea navigation, having been now thoroughly established, their employment became universal; and the size, power, and number of the vessels increased daily in every part of the empire.

(*To be continued.*)

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LIST OF ENGLISH PATENTS GRANTED BETWEEN DEC. 26 AND DEC. 31, 1846.

Thomas Edge, of Great Peter-street, Westminster, gas-meter manufacturer, for improvements in the manufacture of gas-meters. Dec. 31; six months.

George David Myers, of Bridge-row, London, engraver and printer, William Cooper, of Saint Paul's Churchyard, bonnet manufacturer, and Thomas Wansbrough, of Southwark-square, Surrey, hatter, for improvements in the manufacture of caps, bonnets, bookcovers, curtains, and hangings, show cards or boards, labels, theatrical decorations, and coffins. Dec. 31; six months.

William Knowelden, of Great Guildford-street, Southwark, engineer, for improvements in steam-engines. Dec. 31; six months.

Stephen R. Parkhurst, of Leeds, York, manufacturer, for improvements in carding wool, cotton, and other fibrous substances. Dec. 31; six months.

Clemence Augustus Kurtz, of Salford, Lancaster, manufacturing chemist, for certain improvements in the mode of preparing and using indigo in the dyeing and printing of woollen, cotton, and other fabrics. Dec. 31; six months.

Adrien Chenot, of Clichy la Garenne, near Paris, for certain improvements in the treatment of metallic oxides and other compounds, and in apparatus for the same. Dec. 31; six months.

Charles Dowse, of Camden Town, Middlesex, gentleman, for improvements in applying springs to braces, to portfolios, to hats and caps, and memorandum and other books. Dec. 31; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 22ND OF NOV. TO THE 22ND OF DEC., 1846.

Edward Alfred Cowper, of Smethwick, near Birmingham, engineer, for improvements in the manufacture of railway chairs. Nov. 25.

William Watson Pattinson, of Felling, near Gateshead, Durham, manufacturing chemist, for improvements in the manufacture of chlorine. Nov. 25.

Charles Bertram, of Gateshead, Durham, engineer, for improvements in the manufacture of artificial fuel, and in the application of the residual products to useful purposes. Nov. 25.

Thomas Wood Gray, of Workworth-terrace, Commercial-road, Middlesex, for improvements in ports, and in apparatus for opening and closing ports, of ships or vessels; also applicable in opening and closing windows and other instruments having like movements. Nov. 27.

Alfred Vincent Newton, of 66, Chancery-lane, Middlesex, mechanical draughtsman, for certain improvements to be applied to the grinding of grain and other substances. Nov. 28. (Being a communication from abroad.)

James Caleb Anderson, Bart., of Buttevant Castle, Cork, Ireland, for certain improvements in obtaining motive power, and in applying it to propel carriages and vessels, and to the driving of machinery. Dec. 9.

William Mathers Hall, of Leeds, York, brass-founder, for a certain improvement, or certain improvements in and applicable to sliding gas pendants, lamps, lustres, and chandeliers. Dec. 9.

William Johnson, of Grosvenor Wharf, Millbank, Westminster, gentleman, for certain improvements in machinery for raising, or lifting and lowering weights or ponderous bodies. Dec. 10.

William Johnson, of Grosvenor Wharf, Millbank, Westminster, gentleman, for certain improvements in propelling carriages on railways. Dec. 14.

William Eaton, of Newington, Surrey, engineer, for certain improvements in obtaining motive power. Dec. 14.

John Mercer, of Oakenshaw, Lancaster, chemist, and John Greenwood, of Church, in the same county, chemist, for certain improvements in dyeing and printing Turkey red and other colours. Dec. 16.

Bartholomew Beniowski, of Bow-street, Covent-garden, Middlesex, Major in the late Polish army, for certain improvements in the apparatus for and process of printing. Dec. 17.

John Todd, of Glasgow, Lanark, and William Johnston, of Birmingham, Warwick, engineer, for improvements in arranging the rails on certain parts of railways. Dec. 21.

NOTES AND NOTICES.

Adams and Le Verrier outdone!—Sir William Hamilton has announced to the Royal Irish Academy that he has, by a certain mathematical process, approached, if not actually hit, the central sun, "the star round which the luminary of our own system and his satellites revolve."

The Great Britain.—Mr. Brunel has made a long report to the Company of Proprietors on the state of this vessel, and the best means of saving her. He states, that except the parts actually damaged, the extent of which is comparatively small, the ship is "perfectly sound, and as good as the hour when she struck." He proposes to protect her from breaking up during the passing winter, by forming under the stern, and along the exposed side of the vessel, a fencework of some ten thousand fagots, strongly bound together; and next spring he would lay ways under her, haul her far enough up on the beach to be enabled to repair her, just sufficiently to make her water-tight, and then take her to Liverpool or Bristol. "If she is so brought into port," Mr. Brunel "thinks she may still be worth, unrepaired, £40,000, £50,000, or £100,000, according to the opportunities that may offer themselves of employing her usefully, or of selling her."

Dr. Ritterbrandt's Process for Preventing the Incrustation of Steam-boilers.—The *Times* bears the following powerful testimony to the merits of this invention, which we had the pleasure (we believe) of being the first to bring under the notice of the public:—"The invention has been tried for nearly twelve months upon the boilers of the engines printing the *Times*, working on an average seventeen hours *per diem* throughout the year. Not only have the boilers been kept perfectly free from deposit, but an incrustation which was formed previously to the application of the invention has been completely removed. We can further state, that neither the boilers nor any part of the machinery has been in any, even in the slightest degree, acted upon or injured by the action of the remedy in question." The Institute of Civil Engineers awarded at the close of their last session a Telford medal to Dr. Ritterbrandt for his discovery, and he had previously the honour of receiving the gold Isis medal of the Society of Arts.

NOTICES TO CORRESPONDENTS.

In compliance with the suggestion of several esteemed correspondents, we shall in future—commencing with this, the first number of our new volume—give the contents of each number at the end.

On Saturday next the supplement to Vol. XLV.—Also the volume complete.

Books Received. —"*Muirhead's Correspondence of James Watt on his Discovery of the Theory of the Evaporation of Water.*"—"*Capt. Hotham's Narrative of the Recovery of H.M S. Gorgon.*"—"*Scott's First Books in Science.*"

Mr. Goddard's communication is intended for insertion; as are also those of Tyro and Mechanicus.

The Society of Arts.—"*A Member*" *will find in our last that we have not overlooked the "last new change.*"

Communications received from A. N.—A Royal Engineer — B. B.—Mr. Adamson — Gulielmus — Philo-Scalpel—A Student.

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No Brewing Utensils Required.

THE PATENT CONCENTRATED MALT and HOP EXTRACT enables private individuals to make fine Home-brewed Ale or Porter, without employing any Brewing Utensils. It has only to be dissolved in hot water and fermented. Sold in Jars for samples and other purposes, at 1s. and 1s. 6d.; and in Bottles for brewing Nine to Eighteen Gallons, and upwards, of Ale, at 6s. 6d. and 12s. 6d. each, by the British National Malt Extract Company, 7, Nicholas-lane, Lombard-street; Petty, Wood, and Co., 12, King William-street, City; Wix and Sons, 22, Leadenhall-street; Batty and Co., 15, Finsbury Pavement; Decastro and Peach, 65, Piccadilly; Hockin and Co., 38, Duke-street, Manchester-square, London: Ferris and Scone, Bristol; P. Harris, Digbeth, Birmingham; T. Standring, Piccadilly, Manchester; J. H. and S. Johnson, Church-street, Liverpool; H. C. Baildon, Edinburgh; George Duff, 4, Eden Quay, Dublin; and Oilmen and Grocers generally.

Also, just published, and may be had Gratis,
NATIONAL BREWING; a Guide to the Use of Concentrated Malt and Hop Extract, for Brewing and Wine Making; to which is added Medical Opinions, relative to the virtues of Malt and Hops.
London: DIRCKS and Co., 7, Nicholas-lane, Lombard-street.

Lithography, Colour Printing.

W. SMART and Co., artists and printers, of 10, Leather-lane, Holborn, after 15 years' extensive experience, call attention with confidence to the very superior advantages they have for colour printing, and all other branches of the art, having large premises, and a permanent staff of efficient plan draughtsmen, artists, and printers, the most accurate and expeditious machinery for registering and printing (invented by W. Smart), offering peculiar facilities to produce all work in the best style with despatch and economy.

By H. M. Royal Letters Patent.

Brown & Co.'s Patent Metallic Steam Plate upon a Self-adjusting Principle,

PRESENTS the only perfect mode of applying to Metallic surfaces a uniform heat of any temperature to 400 degrees and upwards of Fahrenheit, with certainty, safety, and economy. The trades and operations requiring particular degrees of heat for some delicate process, are varied and numerous; and every individual who has suffered frequent vexatious losses in spoiled goods, or materials, resulting from its unequal application, will be able to appreciate the value of a large even surface, with a temperature which may be maintained for any period, and so nicely regulated to any required degree, that the most inflammable substances may be securely dried upon it. For drying purposes, Forming Extracts, Essential Oils, and Chemical compounds, the rapid Evaporation of Fluids and Fluid Substances, the Concentration or Solution of Salts, Sugar, &c., the *Patent Steam Plate* is confidently recommended, and may be seen in operation on Mondays, Wednesdays, and Fridays, at the Office of the Patentees, No. 12, Mark-lane.

To Coachbuilders or Capitalists.

THE SOLE PATENTEE of a unique invention for applying HORSE-POWER on RAILROADS, or improved Roads, at HIGH-RATES OF SPEED, wishes to treat with a gentleman who would take an interest in the patent, and join him in producing the invention. To any respectable firm in the trade, the expenditure would be trifling, and under their own control. Address, for particulars, to A. Z., 20, Half Moon-street, Piccadilly.

To Inventors and Patentees.

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(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

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LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1222.] SATURDAY, JANUARY 9, 1847. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

CLARK'S IMPROVED PYRO-HYDRO-PNEUMATIC APPARATUS.

Fig. 1.

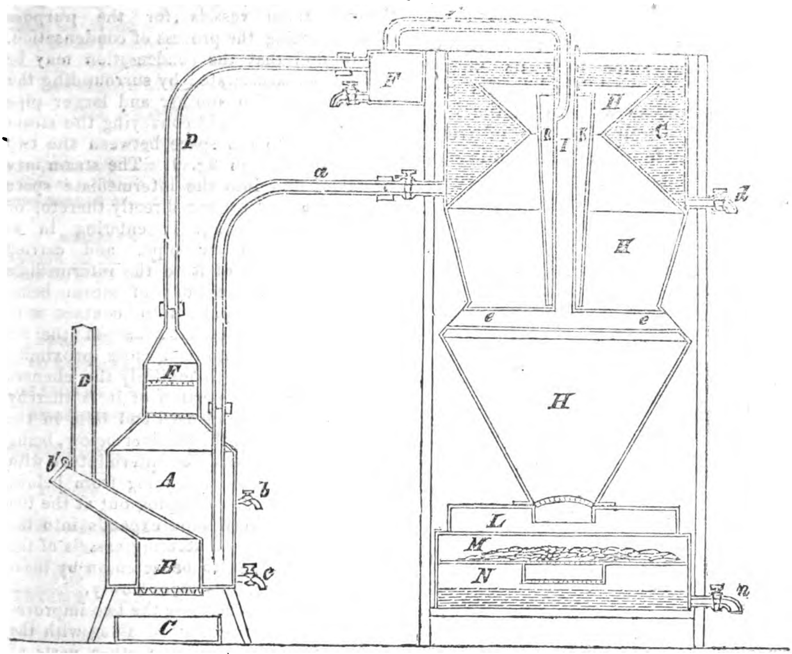


Fig. 3.

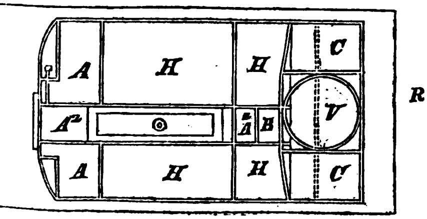


Fig. 2ª.

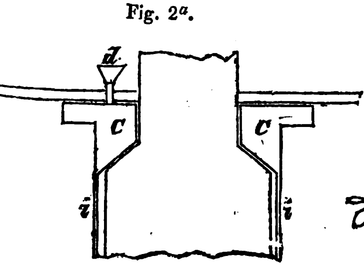
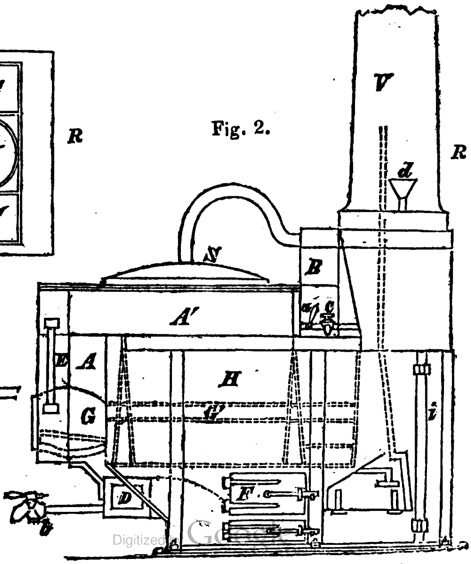


Fig. 2.



CLARK'S IMPROVED PYRO-HYDRO-PNEUMATIC APPARATUS.

[Patent dated June 29, 1846; Specification enrolled, December 29, 1846.]

Little more than three years ago we described the original pyro-hydro-pneumatic apparatus of Mr. Clark, which had for its great (though not sole) object, the conversion of salt sea-water into sparkling fresh water (vol. xxxix, p. 145;) and since then its merits have been fully established by its use on board ships, as well as at the Isle of Ascension, (itself destitute of fresh water,) for the supply of the public servants on that station, and of the ships which are compelled to resort to it from the coast of Africa, and other parts, for supplies of this first necessary of life. In the merchant service, its utility has been tested in vessels trading to the warm countries of the East, where the rapidity with which the purest water changes to a state of putrescence, makes it of incomparable importance to be able to impart freshness and sweetness to any water, however foul, (for the applicability of the machine is not confined to merely salt water alone;) and its more general adoption in all long sea-going vessels cannot be far distant.

Mr. Clark has made several improvements in his invention, in the course of reducing it to practice. These he has made collectively the subject of a new patent, the specification of which we have now before us. The most important of these improvements appears to be the combination of the pyro-hydro-pneumatic apparatus with the ordinary cooking hearths of ships, so as to make one fire available for the purposes of both. Not only the cost of the apparatus, and of working it, but the space occupied by it, (in small ships an object of first consideration,) must by this arrangement be most materially reduced. Among the improvements, there is one for accelerating the evaporation of water, which, if it prove applicable to steam engine boilers, for which it is also claimed, will be of a utility far extended beyond that of the apparatus which has immediately given rise to it.

With these remarks, we now proceed to lay before our readers Mr. Clark's own account (with some little abridgment) of his improvements:

Firstly ; to prevent priming, I insert one, two, or more perforated plates in the still head.

Secondly: in the apparatus as originally constructed, three condensing and aërating vessels of a conical form were employed, and a cold air pipe was carried up through these vessels for the purpose of accelerating the process of condensation. I now find that the condensation may be still further accelerated by surrounding the cold air pipe with another and larger pipe of a conical form, and conveying the steam first of all into the space between the two pipes as shown in fig. 1. The steam may be introduced into the intermediate space either by a pipe leading directly thereto, or by a pipe, as in fig. 1, entering in at the top of the air pipe, and carried through the side of it to the intermediate space. The whole body of steam being thus brought at once into contact with the whole of the cold surface of the air tube, or at least into such close proximity therewith as vastly to multiply the chances of contact, a large portion of it is thereby almost instantly condensed and falls in the form of water into the receiver below, being aërated in its descent by intermixture with the currents of air ascending from below, while the remainder escaping out at the top of the outer conical pipe expands into the three condensing and aërating vessels of the original apparatus, to be acted on by them in the same way, only more slowly.

Thirdly: by combining the two improvements last before described along with the more essential only of the other parts of the original invention, I am enabled to produce an apparatus capable of yielding from 2 to 2½ gallons of fresh water per hour, which occupies no more than a space of about 24½ cubic feet, and may be therefore employed without inconvenience on board of ships of small size, and either as a fixture between decks, or as a portable article which may be moved about from place to place. A sectional elevation of this apparatus is given in fig. 1. A is the boiler, which is connected by a feed-pipe, *a*, with an open sea-water cistern, G; *b*, boiler gauge-cock; B, the furnace, and b^1, the funnel for feeding it with fuel; C, the ash-pan; D, the chimney; E, the still-head, constructed in the improved manner before described; P, a pipe, through which the steam passes from the still-head E to the rectifier F, whence it is carried over by a pipe, *f*, into the central air-pipe, I, of the condensing and aërating vessels HHH, and through the side of that pipe into the space between it and a conical pipe, K, by which it is surrounded, as last before directed; *e e* are air-pipes passing laterally through the vessels HHH; L,

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Fig. 4.

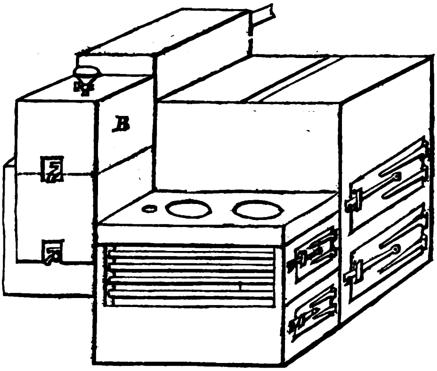


Fig. 5.

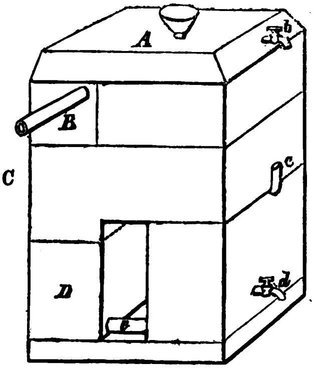


Fig. 6.

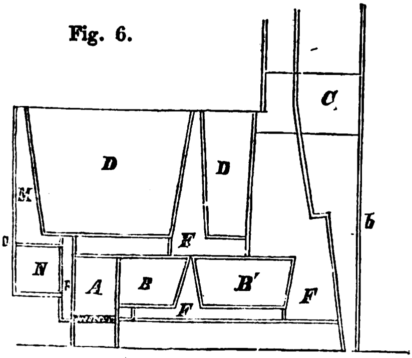


Fig. 7.

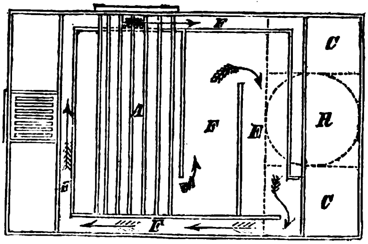


Fig. 8.

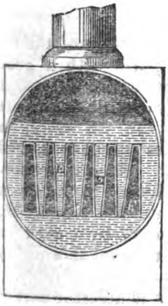


Fig. 9.

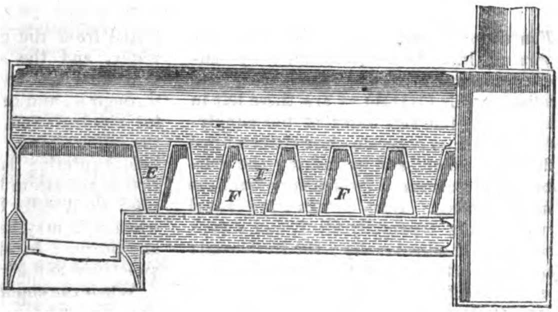
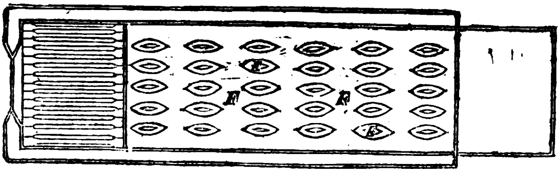


Fig. 10.



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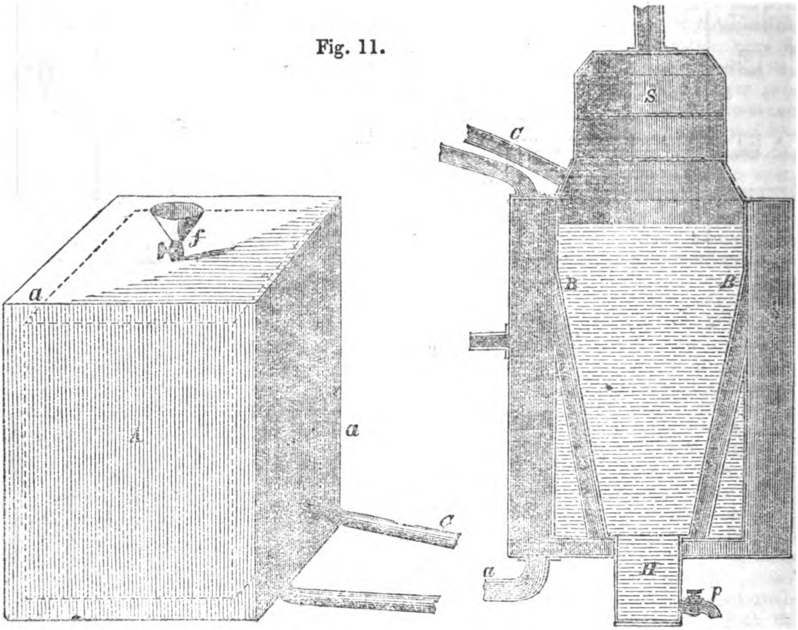
the purified and aërated water-receiver; M, filter, and N, the fresh-water reservoir, from which it is drawn off for use by the cock *n*. In using this apparatus, care must be taken to draw off from time to time the brine resulting from the evaporation of the sea-water in the boiler, by means of the cock *c*. The supply-cistern G should also be cleared occasionally of any deposit which may take place in it by opening the brine-cock *d*.

Fig. 11.



Fourthly: I still further improve the apparatus last before described by enclosing so much of the condensing and aërating vessels (HHH) as are there left in contact with the salt water of the supply-cistern (G), in a separate close cistern filled with fresh water, and by making the salt-water supply-cistern G (which surrounds the other) also close. Each cistern has a funnel by which it is separately filled, and a cock for clearing it occasionally; the fresh-water cock being attached to the outer end of a pipe carried from the fresh-water or inner cistern through the sea-water or outer cistern. The steam pipe (P) is, in this case, carried from the rectifier (F) in an upwardly inclined position, first through the sea water of the supply-cistern (G), and then over into the air pipe (I) of the condensing and aërating vessels, as in the apparatus last before described. The advantages attending this modification of the apparatus are, that the condensing and aërating vessels are protected from the corrosive action of the sea water, and the steam parts with a good deal of its heat to the sea water in its passage through it, and becomes thus in a fitter state for condensation, while the sea water, on the other hand, becomes partially heated before entering the boiler. Should any portion of the steam be condensed in the steam pipe P, it falls back into the rectifier F, whence it may be drawn off by a cock for any purpose to which water not thoroughly sweetened and aërated may be applicable.

When the condensing and aërating part of the apparatus happens to be placed on a lower level than the boiler, (as may under many circumstances be expedient,) then the sea-water supply-cistern must be wholly detached therefrom, and placed in some other situation above the level of the boiler, and the close fresh-water cistern only left at the top of the condensing and aërating apparatus.

Fifthly: I combine my pyro-hydro-pneu-

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matic apparatus, including the improvements before described, with the ordinary cooking hearths of men-of-war and other large sailing vessels, in such manner and with such suitable modifications and additions as to make one fire or set of fires serve the purposes of both. The cooking hearths used in vessels of the above description, consist commonly of a long range, with a fire for roasting, behind the back plate of which range there is a baking oven, and next to it a furnace, above which three cooking pans are placed in a row, side by side, surrounded by a wrought-iron casing, which admits of the heat of the furnace playing round the sides as well as acting on the bottoms of the pans.

In the hearths used in the combination about to be described, the parts are nearly the same, but arranged differently, so as to increase the length of the hearth, and thereby admit of the pyro-hydro-pneumatic apparatus being more conveniently united therewith. For the sake, also, of embracing the whole within as small an area of the vessel as may be, the pyro-hydro-pneumatic apparatus is not all placed on the same level or deck with the hearth, but portions of it only on the same deck, and portions of it on the deck or in the hold beneath. Figure 2 of the annexed drawings represents a side elevation; figure 2*a* part of front elevation, and fig. 3 a top plan of a ship's hearth as so modified, and of so much of the pyro-hydro-pneumatic apparatus as is on the same deck, and immediately connected therewith. R is the range; V, the chimney; F, the usual furnace; HHH, the three cooking pans, newly arranged as aforesaid; A A^2, a boiler of a T form, for evaporating the sea water intended to be converted into fresh, which is placed partly between and partly behind the cooking pans, as shown; and CC, two close cisterns placed upon the range, one on each side of the chimney V, which are kept filled (through funnels *d*) with sea water, and are connected by a pipe, which communicates by another short pipe (having a cock, *a*) with the boiler, A. As the pans, H, and the piece A of the boiler, are the only parts which are immediately above the furnace, and have the full benefit thereof, a small auxiliary furnace, G, is inserted at the back of the apparatus into the midst of the water, in the main-piece, A, of the boiler, and a flue, G^1, carried from it right through the piece, A^2, to the chimney. S is the steam, or still-head, which is made with a perforated plate, or plates, to prevent priming, as firstly before described. B is a rectifier, from which the steam is conveyed by two pipes, *i i*, through the supply-cisterns, CC, and thence down to the condensing, aërating, and other portions of the pyro-hydro-pneumatic apparatus placed in the hold, or on the deck beneath. D is a brine-box; *b*, brine-tap; *c*, tap to rectifier; and E, a glass gauge attached to the boiler. The parts placed in the hold, or on the deck beneath, are in all respects the same as the corresponding parts of the modification of the apparatus, fourthly before described, wherein the sea-water cistern is detached from the condensing and aërating vessels, and need not therefore be here again described. Any man-of-war's, or other ship's hearth, which is of size enough to do cooking for the ship's company, will, by means of the modifications and additions which have been just described, be able also to furnish a supply of fresh water equal to the rate of one gallon per man per day; and this at no more additional expense for fuel than is requisite to feed the small auxiliary furnace (G).

Sixthly: to extend at a cheap rate the benefits of the pyro-hydro-pneumatic apparatus to the smaller classes of merchant vessels, I adopt the arrangements represented in fig. 4. Such hearths consist usually of a hot plate in front, having holes in it for the reception of cooking vessels, beneath which are the furnace and roasting range, and behind a baking oven, on the top of which one or more cooking pans are placed. In my improved arrangement, I attach to the side of the hearth opposite the furnace a boiler, B, to contain the salt water which is to be converted into fresh, and carry a flue from the furnace under and around the bottom part of this boiler; and the better to secure an ample and constant supply of heat to the boiler, I substitute for the hot plate a rectangular box, which is open at one side to the boiler, and serves, in fact, as a small auxiliary boiler to the other; inserting holes in this steam-box similar to those in the hot plate, so as not to interfere with its separate use as a hot plate. The steam, or still-head, is made of the improved description, firstly before decribed, and the steam may be conveyed from it to a set of rectifying, condensing, aërating and filtering vessels constructed on the plan of the pyro-hydro-pneumatic apparatus, and placed behind the hearth. An apparatus such as has been just described, and of size enough to do the cooking for a ship's company of ten men, would also yield from one to two gallons of fresh water per hour, without any additional cost whatever for fuel, and with no more trouble than that of keeping the boiler supplied with sea water, and occasionally draw-

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ing off the brine. Should still greater cheapness be required, and the aërating of the fresh water be regarded as a matter of indifference, a condenser and filter of the description represented in fig. 5, may be employed and placed immediately behind the cooking hearth. The uppermost compartment, A, of this apparatus is about four inches deep, and has a funnel, through which it is filled with refrigerating sea water, which, when it becomes too hot, is drawn off by a cock, *b*, and replaced; one pailful, three or four times a day, is all that is wanted. Beneath this is the rectifier, B, and a steam chamber, C, in which last there are one or more perforated metal plates for the purpose of aiding liquefaction. As the pressure of the steam increases, while a portion of it is being condensed into hot water, the air and the water must pass through the filter, D, and by means of the tube, *e*, into the fresh-water cistern, from which it is drawn off by a cock, *d*; *c* is a small vertical pipe for letting the air pass in and out. The product not being aërated, will be vapid, but pure and fit for cooking, making tea and coffee, &c., and, when filtered a second time, it will also be fit for drinking.

Seventhly: in order to make the heat of ships' cooking hearths still more extensively available to the conjunct purpose of converting sea water into fresh; that is to say, to make the two combined apparatuses do a greater amount of duty with a given expenditure of fuel than by any of the arrangements before described, I construct the hearths in the improved manner represented in figs. 6 and 7; fig. 6 being a side elevation, and fig. 7 a plan on the line *a b* of fig. 6. A is the cooking furnace, which, it will be seen, is placed at a much greater distance from the range (R) than usual; B is a baking oven, as before; B^1, a second baking oven, which is introduced into the space between the furnace and range; CC are the salt-water supply-cisterns; M, the boiler; N, brine-box; DD, cooking-pans; FFF, flues, which are so arranged that the heat from the furnace is made to traverse all under and around the bottom of the cooking pans and ovens, and alongside and through the boiler, before escaping into the chimney. The other parts of the apparatus, that is to say, the rectifying, condensing, aërating, and filtering parts are, in all respects, the same as in that described under the fifth head of this specification.

Eighthly: in order to produce a more rapid evaporation of the sea water in the boilers of the pyro-hydro-pneumatic apparatus, whether employed in its original form, or in any of the improved forms which have been now described, and also in all other boilers to which this part of the said apparatus is applicable, I construct the boiler in the manner exemplified in figs. 8, 9, and 10 of the engravings annexed; fig. 8 being a cross section, fig. 9 a side view, and fig. 10 a plan. A broad flue, F, extends straight from the furnace through the midst of the water in the boiler to the chimney, and in this flue there are placed one, two, or more rows of vertical evaporators, EEE, which are open at top and bottom, and present sideways the form of an inverted pyramid, but are, in their cross section, of the shape of an oblate spheroid, as shown in the plan, fig. 10. I place these evaporators in straight rows, parallel to the sides of the flue F, and make them of an oblate spheroidal form, in order that they may offer as little interruption as may be to the furnace draught. A small body of water being brought in each of these evaporators into immediate contact with their intensely heated surfaces, is very rapidly raised to the steam point, and, ascending to the top of the water in the boiler, gives place to another body of water, to be heated in like manner, and so the operation goes on unceasingly.

Ninthly: my invention consists in the adaptation, in manner following, of parts of the pyro-hydro-pneumatic apparatus to steam-vessels, and in certain alterations in the steam generators of such vessels, to render them suitable for such adaptation. Most sea-going steamers are provided with condensers of some sort or other for converting a portion of the steam of the engine boilers into fresh water; but complaints are general of the quality of the water thus obtained, which is frequently so bad that even the live stock on board refuse it. And this must be always more or less the case, as long as the steam (of sea-water) sought to be condensed is of so intensely hot a description as that given off by engine boilers. The improved arrangement for the purpose of supplying such vessels with a constant supply of fresh water, is represented in fig. 15. A is a close cistern kept filled, through a funnel, *f*, with sea water, and enclosed in a steam jacket, *a a*. B is a boiler which is also provided with a steam jacket, *b b*, and is supplied with water by the pipe, C, from the cistern, A. DD are a number of small tubes which are passed obliquely from one side of the boiler jacket down through the water in the boiler, to the bottom portion of the jacket, (or may be carried in any other direction,) for the purpose of accelerating evaporation. S is the steam, or still-head, which is constructed in the improved manner described under the first head of this

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specification. The steam for the heating of both jackets is obtained from the engine-boiler by the pipe F, and being returned with but little loss from condensation by the pipe G, it abstracts but little from the power of the engine. H is a brine-box, and *h* brine-cock. From the steam, or still-head, the steam is carried off to a set of rectifying, condensing, aërating, and filtering vessels, as in the other arrangements before described.

THE COLLEGE FOR CIVIL ENGINEERS.

The subject of this institution has not escaped our memory; but so many matters have pressed upon our editorial attention during the past few months, as to preclude our completing the discussion upon which we entered some time back. We have received several letters on the subject, and have had frequent personal inquiries made as to the details of this college. Having no personal interest in the institution, nor means of information greatly superior to any other person, we have often been unable to answer either the letters or the inquiries. We feel it due, however, to the Principal of the college to state, that whenever we have thought it desirable to make any special inquiry, we have always been treated with the most gentleman-like courtesy, and furnished with the information we required with the utmost promptitude and candour. We are indeed convinced that Mr. Cowie has nothing to conceal, and that acting an open, decided, and straightforward part, he is prepared at all times both to state and to justify his proceedings. We are convinced, too, from what we have seen, that such would be the experience of every gentleman who may be led to make similar inquiries for any honest and ingenuous purpose whatever; whether the application relate to any principle or practice in regard to education, or to any engineering or other scientific results, which the investigations or experiments carried on in the college might have placed within the special knowledge of the Principal. We say thus much of our own personal knowledge: it has been our uniform experience, that the college system is open to the fullest investigation that any man has a right to make into the condition, whether moral, intellectual, or professional, of any institution whatever, not strictly forming a department of the public service.

Perhaps some of our readers may be curious to know what kind of objections *can be* made to a seminary for training young men, varying from the ages of 14 to 20 in this Christian country, in the year of our Lord 1846; and we will gratify their curiosity by a single specimen, which we select from several, on the ground of its being the briefest of this kind that has reached us:

To the Editor of the Mechanics' Magazine.

Sir,—Seldom as it is that I trouble you with a remark, I cannot on the present occasion refrain from it. A college has been established at Putney, called "A College for Civil Engineers," from which I presume most persons would be led to suppose that young men are there educated in all the branches of civil engineering. I have, however, learned that a new class has been made up of late, which consists of Lectures on the New Testament! Now, may I ask, what this can have to do with engineering? I consider it a deception on the public in general, (who I believe are, for the most part, ignorant of the fact,) more especially on those who send their sons there to be educated as engineers. A few words occasionally draggle out behind the "College for Civil Engineers," (fair words to look upon,) but is this practical or is it scientific? For my own part I cannot see much reference to either, though perhaps some of your readers may. One strenuous objection I would urge against it is—that all, *volentes nolentesque*, are alike obliged to attend. Surely it does no young man good to attend these lectures against his will. Is he better in a scriptural sense? Hoping you will excuse my serious interrogations, for this is a mysterious affair, may I ask who is the originator (a clever invention) of these lectures, and have they received the sanction of the learned council? I am a man I hope of pure religious principles, but when these are carried too far, they are not religion. In conclusion I would only say, I hope this will soon come to an end, or a young man will have to go elsewhere to become

A Civil Engineer and Architect.

London, Nov. 29, 1846.

The sum and substance of this complaint we take to be this—"of what use is Christianity towards getting money?" We think, that even under this vulgar aspect we could satisfy any *reasonable* man. It would only require us to remark—that as the rights of labour and the rights of intellect have been recog-

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nised by the Christian world alone; and that as those laws which secure to every man the products of his industry and the exercise of his faculties, are professedly founded on the precepts of the New Testament;—it follows that every honest individual is interested in a *worldly* sense in the conservation of Christianity. Every man is protected from the rapacity of others; and whether our laws be in every case equitable or not, our common Christianity reads a lesson for their amendment when defective, and is their foundation where they are just and perfect. We should feel ashamed, however, to urge this argument in favour of Christianity as the only one, or even as the principal one, that is adducible: but as it is the only one which is appreciable by such minds as that of our correspondent, we have no alternative to the degradation, intellectually and morally, implied in its adoption.

Does our "Architect and Civil Engineer" wish to unloose the bands that hold society together? To excise what Woolaston happily calls religion—"a bridle in the mouth of the wild beast, man?" Or does he imagine that men of *our* profession are to be freed from those restraints, which are so necessary to suppress the exuberant vices of other men? Shame on him! And shame on ourselves, did we not reprove the unjust insinuation conveyed in the signature under which he writes!

But the true state of the case, which that writer has so disingenuously tortured, is the best answer to his letter.

The students of the college (with the exception of a very small number who are non-resident) live wholly in the college-apartments; and receive their *entire* education—scientific, professional, moral and religious—from the Principal and the several professors. Now, would any Christian parent (or, we might ask, any parent whatever) wish his son to grow up to maturity, in perfect ignorance of the Gospel or his Christian duties? If such there be, let them seek instruction elsewhere: at Putney it is not to be so obtained.

The Lectures on the New Testament were instituted by the *present* Principal. They were intended as a means of conveying to all the students some knowledge of the history, geography, and other peculiar characteristics of the Holy Scriptures; and for the purpose of familiarising their young minds with the formal enunciation of the great verities of the Christian faith. They were instituted at the suggestion of the highest ecclesiastical authority, and at the urgent request of a great number of parents, as well as on the settled conviction of the Principal himself: for under every aspect, it appeared not only desirable but essential, that where a body of young men are to receive the *whole* of their instruction within the walls of the college, the fundamental principles of Christianity should not be the sole subject omitted. We, as well as those who recommended and who founded the rule, did view religion as *professional* to every man, as it ought to be the fundamental guide of his earthly career. Were the college, indeed, a mere hall for the delivery of lectures on science, art, or literature, we may presume that the parents would provide for their sons a suitable amount of religious instruction, and no demand need be made on the institution to supply it: but we are sure that no parent, especially no Christian parent, will think *two hours in the week* as thrown away, by being devoted to a careful explanation and diligent study of the Gospel history.

Our correspondent complains that *all* the students are obliged to attend this lecture, and he asks of what benefit it can be to him who attends unwillingly? Let him apply this principle to the mathematical, architectural, or engineering lectures, which we will suppose he attends "against his will." We should say that such a student as this would act wisely in leaving the college, instead of uselessly occupying the place which a young man of a different order would be glad to fill. We always entertain grave suspicions of professed irreligion, or even of professed doubts, in young and uncultivated minds. It bespeaks a wild recklessness and ignorant self-conceit to reject, in so summary a manner, the views which have been entertained by men quite as illustrious as any neophyte free-thinker can ever hope to become: and when we witness this spirit, either in respect of religion or of science, of literature or of art, we have always augured unfavourably of the future career of the young zealot, and our augury has seldom indeed been unverified. "Seest

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thou a man that is wise in his own conceit:—there is more hope of a fool than of him."

It is no mean source of gratification to be convinced, that, under the present system of conducting the College for Civil Engineers, there is none of that gross immorality and licentious outrage to be found amongst the present students, which so fearfully prevailed during the period of military occupation and management. The students do not *now* make an *auto da fe* of the sacred volume: nor are they a terror to the surrounding district, as they once were. "The Bishop of London," (says the Civil Engineer and Architect's Journal, August, 1846, in reporting the distribution of prizes,) "in his usual felicitous manner, eulogised the moral and gentlemanly deportment of the students. For living in the vicinity he had taken great interest in the subject, and had uniformly found that his neighbours concurred with him in giving the college this merit. Their testimony was of the greatest value, because founded on impartial personal observation."

We think no one will contend that morality at least *is not* an essential condition to regular and successful study. We never see a dissipated young man with a disciplined intellect. The very circumstance, then, of so considerable a change in the moral state of that college, as has resulted from the change in its system of management, speaks favourably of its intellectual and professional condition. Nor have we been disappointed in our scrutiny into this matter: we have reason to believe, that it is as greatly improved in respect to the character of the education, and the acquirements of the students, as it is improved in its moral and social condition. We must, however, defer this subject to a following number.

TE HYPERBOGRAPH, AND CASES TO WHICH IT IS APPLICABLE.

Sir,—I have the honour of forwarding the discussion, promised at page 517 of the last volume of your valuable Journal, of the different cases to which the hyperbograph is applicable.

Case 1.

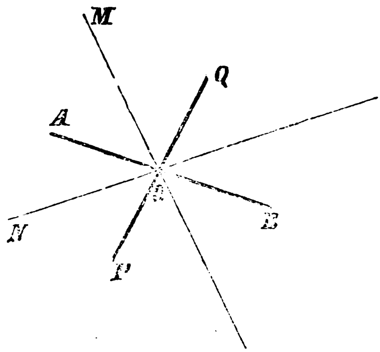
Given an asymptote, the centre, the direction of the minor axis and any point of the curve.

This is the case to which the instrument is directly applicable, as has been explained at page 517; but as in the following cases it is frequently referred to I have thought it well to repeat the enunciation.

Case 2.

Given any two conjugate diameters.

Fig. 1.

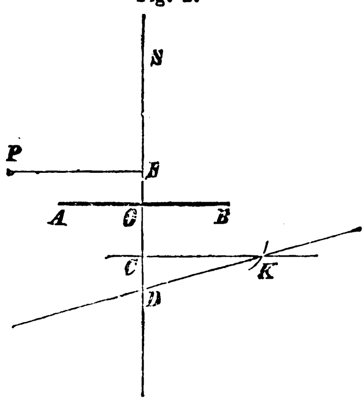


Let AB and PQ be any two conjugate diameters. Through the centre O, draw OM and ON repectively parallel to AP and AQ. These will be the asymptotes (Davies' Hutton, vol. ii., Prop. C. p. 159.) Bisecting the angle MON will give the minor axis, and P being a point of the curve, we then obtain the data of Case 1.

Case 3.

Given the transverse diameter and any point of the curve.

Fig. 2.

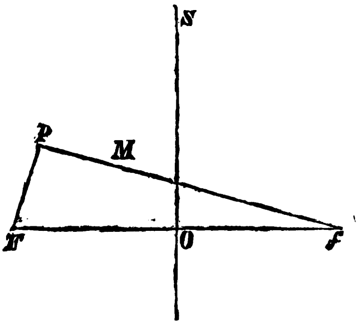


Let AB be the transverse diameter, and P the given point of the curve. Determine the minor axis SD, and draw PF perpendicular to it. On the minor axis set off FC and OD, each equal to AO, the semi transverse. Through C draw CK parallel to AB, and with centre F and distance FP cut this parallel in K. Join DK, which will be the parallel to the asymptote marked VKV, in fig. 2, of page 516. This is evident from Theorem 3, page 485. The hyperbograph is now immediately applicable, for the asymptote itself is not required.

Case 4.

Given the two foci and any point of the curve.

Fig. 3.

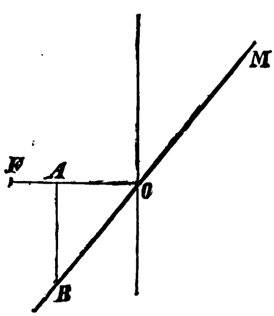


Let F and f be the two foci, and P the given point. Join PF, P f, and make PM = PF; then M f is equal to the transverse diameter, (Davies' Hutton, vol. ii., Prop. 7, page 149,) half of which being set off on each side of O reduces this case to Case 3.

Case 5.

Given the centre, a focus and an asymptote.

Fig. 4.

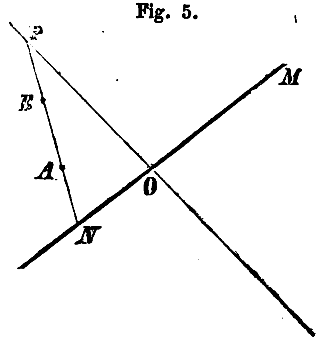


Let O be the centre, F the focus, and BM the asymptote. Join OF; on the asymptote set off OB equal to OF, and draw BA perpendicular to OF. A is the vertex (Davies, vol. ii., Prop. 6, page 149, and Prop. A, page 156,) whence we obtain the data of Case 1, for the direction of the minor axis is also known, being perpendicular to OF.

Case 6.

Given two points, an asymptote and the centre.

Fig. 5.

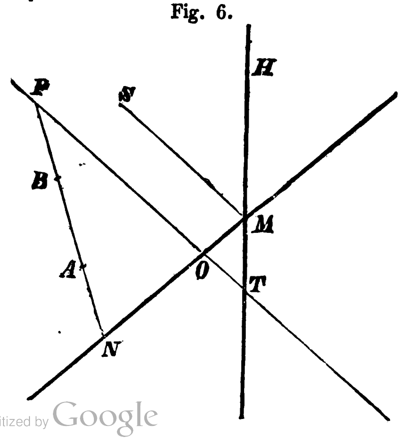


Let A and B be two points, O the centre, and NM the asymptote. Join BA, which produce to meet the asymptote in N, and set off BP in the opposite direction equal to AN; P is a point of the other asymptote, (Davies, vol. ii., Prop. B, page 158,) which is therefore determined, since it must pass through the centre. Bisecting the angle POM, we get the minor axis, which reduces this case to Case 1.

Case 7.

Given two points, an asymptote and a parallel to either axis.

Fig. 6.



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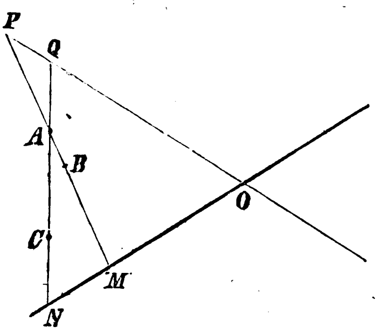
Let A and B be the two points, NM the asymptote, and HT a parallel to the minor axis. Since each axis bisects the angle of the two asymptotes; if we make the angle HMS, equal to the angle NMT, MS will evidently be a parallel to the other asymptote: hence determining, as in the last case, the point P belonging to the asymptote, it will be completely determined. Drawing PT parallel to SM gives the centre O, whence we have the same data as in Case 6.

Case 8.

Given three points and an asymptote.

Fig. 7.



Let ABC be the three given points, and NMO the given asymptote.

Join AC, AB which produce to meet the asymptote in N and M. Make AQ and AP respectively equal to CN and BM, but in opposite directions; P and Q will be on the other asymptote. It is therefore determined, and the construction may be carried on, as in Case 6.

These are the most simple cases which have occurred to me for the application of the hyperbograph; others may easily be proposed, as also modifications of these, with respect to the position of the data, but the construction in these cases will easily suggest itself to the reader. Thus, in Case 8, the given points may be situated on different sides of the asymptote, in which case they will evidently belong to opposite branches of the required hyperbola, but the construction will not be altered. The position of the data may be such as to render the problem impossible: for instance, if two of the points are on a parallel to the given asymptote; but the impossibility will always be indicated by the construction itself, which, in this case, would give for the other asymptote a parallel to the former; hence the curve would have no centre.

I remain, Sir, yours respectfully,

Hugh Godfray.

St. Mark's Road, Jersey, Dec. 12, 1846.

THE NATIONAL MALT-EXTRACT COMPANY.

Sir,—"A Chemist's" letter in yours of the 6th ult. has only just come under my observation, or I should have replied to it earlier.

As personal recrimination will neither elucidate truth nor creditably occupy your valuable space, I will briefly recapitulate the statements made in my first letter which appeared in your journal of Oct. 24th, and, for the *third time*, challenge "A Chemist," or any other partisan, to refute them. I showed that, with malt at 9s. per bushel, and hops at 1s. 4d. per lb., 1 barrel, or 36 gallons, of home-brewed ale could be made for 21s. less than the same quantity of the same strength would cost, if manufactured from the patent extract. I also showed, assuming both articles to be unadulterated, that in beer at 1s. per gallon, a saving—taking cost and density into account—of upwards of 50 per cent. would accrue to the consumer, by purchasing his beer of the brewer instead of the Malt-Extract Company, independent of the difference between getting a fully-made article and one only partly manufactured.

On these propositions I take my stand. If any feel inclined to dispute them, there are the figures, by an impartial examination of which I am content to be judged; and that "A Chemist" may no longer be "perplexed" as to what is my motive, I tell him candidly, that it *is* "to protect society from imposition." Had I been less confident in the accuracy of my calculations than I am, I might, perhaps, have concealed my calling, or, at all events, have endeavoured to do so by writing more anonymously; but it is for the public to decide between the figures of an (interested, if you like) practical man, and the disinterested (query?) lucubrations of your correspondent, who studiously avoids noticing them.

Yours respectfully,

A Brewer.

Oakham, Jan. 2, 1847.

P.S. In your magazine of Dec. 12th, is another testimonial from Dr. Ure. I would simply remark, that, as he leaves untouched the comparative cost of the two processes, he tacitly confirms what I have advanced.

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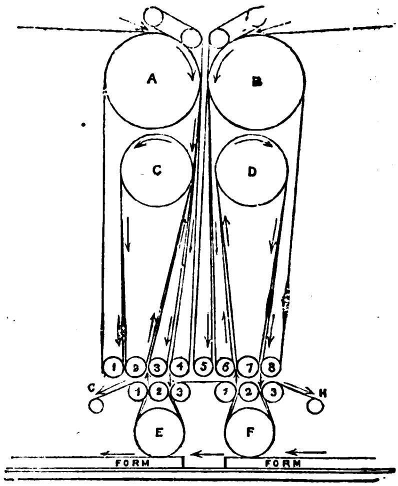
LITTLE'S PATENT DOUBLE-ACTION PERFECTING MACHINE.

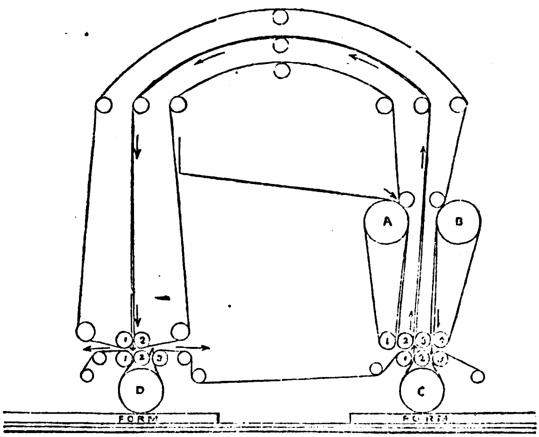
Fig. 1.



In a previous number of our Journal, we had the pleasure of presenting to our readers a description of Mr. Little's important invention of the Double-Action Printing Machine. We ought then to have observed, when speaking of the number of impressions produced by this machine in a given time, that these were one-side impressions only; not that such information was required by persons acquainted with the art of printing, who must have fully comprehended what was meant, but for the sake of the general reader, who might be apt to fall into the mistake of supposing the word *impression* to mean, as well technically as popularly, a *perfect copy*, and thereby to assign to the machine a higher degree of potentiality than it really possesses, or than is claimed for it by its ingenious inventor.

Mr. Little, however, has his perfecting machine also, (as those which print a sheet of paper on both sides before leaving the machine are called;) and we have now the further pleasure of briefl yexplaining, with the aid of the accompanying diagrams, the manner of its construction. Of the importance of this class of machines, and of the value of Mr. Little's improvements in them, some idea may be formed when we state, that, with the exception of the daily papers, and some of the London weekly papers, the working of the majority of country papers, and of the great mass of general printing, is effected by them, and that their average rate of production does not exceed nine hundred sheets per hour, while Mr. Little's perfecting machines can turn out from twice to nearly four times as many.

Fig. 2.



The diagram fig. 1 represents a perfecting machine, with two cylinders. Both forms are placed on the same table about six inches apart. The blank sheet enters successively by a double feeding arrangement on the drums A and B; there

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being the same interval of space between the drums as exists between the forms, so that each sheet meets its form at the proper time. The sheet after receiving the first impression, or being printed on one side, then proceeds in the direction indicated by the arrows, and is carried over the drums C and D, by which *turn over* it has its position reversed, and presents its unprinted side to the cylinders on the opposite side. The perfected sheet then proceeds over the drums C and D, and comes out alternately at the points G and H. The extent of traverse in this machine is 9 feet; and, at a speed of 3 feet per second, it produces 2400 perfect sheets per hour; at a speed of 4 feet, it produces 3180.

The diagram fig. 2 represents a perfecting machine for working wood engravings, with 12 inch cylinders.* The cylinder C works double with the letter-press form, and the cylinder D works double with the form containing the engravings. The blank paper enters on the drums A and B, and after receiving an impression from the letter-press form proceeds in the direction indicated by the arrows to the cylinder D, when it is again impressed on the blank side, from the form containing the engravings; the perfect sheets coming out alternately, at the points indicated by the arrows. The traverse of this machine is 7 feet; and, at a speed of 3 feet per second, it produces 1530 perfect sheets per hour; at a speed of 4 feet, 2040.

A machine constructed on this principle, with cylinders reduced to six inches, would produce from a speed of 3 feet per second, 1800 perfect sheets per hour; and from 4 feet per second, 2400 perfected sheets per hour.

* Lest the practicability of working wood engravings from a 12-inch cylinder should be doubted, we may state, that through the skill and perseverence of Mr. J. Barrett, the Illustrated London News has been worked with cylinders of this diameter, during the last three years, at a speed varying from $3\frac{1}{2}$ to 4 feet per second.

ON THE COMPRESSED-AIR LOCOMOTIVE.

Sir,—Before noticing the new system of condensing, I will point out the defects of the common system. Let us suppose that a double-acting condensing pump, of a capacity of B cubic feet, is used to force air into a reservoir of V cubic feet, and let us suppose it to be making that stroke, at the end of which the density of the air in the reservoir will become 64. Then the resistance against the piston at the end of the stroke will be the pressure of 64 atmospheres minus that of the superincumbent air, or that of 63 atmospheres: at the beginning of the stroke the pressure is nothing, therefore throughout the stroke (if the area of the piston be one foot) the pressure will continually increase from 0 to $63 \times 144 \times 15$ lbs. The quantity of steam of the common pressure required to make this stroke would be*

$$V. \{64 \log._\varepsilon 64 - n \log._\varepsilon n - (64 - n)\}$$

where n is the density of the air in the receiver, at the commencement of the stroke. But no fly-wheel would enable us to perform this work with this amount of steam only, the difference of the pressures being far too great. This is the first defect, viz., that the very nature of the work requires a far greater amount of steam than is theoretically necessary. A second defect is the enormous strain exerted by a pressure of 63 atmospheres, and the necessarily corresponding strength and weight of machinery. A third is the great tendency to leakage between the piston and cylinder, necessitating a difficult exactness of construction, and an increased friction from the necessarily tighter fitting of the piston. A fourth defect is the now really enormous amount of heat manifested by the sudden compression of air to a density of 64, which no amount of artificial cooling would obviate; and the consequent increased power required. In fact, so impossible would it be to compress air to any extent by this method, that I believe it has never been attempted. A plan of remedying the first defect was adopted by the portable gas companies, by whom the gas was compressed to 40 atmospheres. This was to employ several double-acting pumps, attached to cranks on the same shaft, at such angular distances that each pump should be at a different part of its stroke, by which means the pressure was equalised, and by the assistance of a fly-wheel no more steam was used than was necessary to balance the average of the pressures. This plan is used at the Polytechnic Institution for pumping the air into the diving-bell, where three pumps attached to a three-throw crank are employed.

* Vide Postscript.

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Another method was adopted by M. Thilorier, to whom the French Royal Academy of Science decreed two years in succession the Monthyon mechanical prize for his gas-compressing apparatus.*

He connected the lever-beam, to which the pump piston-rods were attached, with a fusee, so that at the beginning of the stroke, when the resistance is 0, the power was virtually applied near to the centre of motion, and at the end of the stroke, when the pressure is very great, the power was applied at a great distance, so that the pressure throughout the stroke might be nearly equalised. This might be done with accuracy, if the difference between the least and greatest pressure were always the same; but it is obvious that a fusee constructed so as to equalise the pressure, in compressing from 1 to 3 atmospheres, would be very different from that required to compress from 1 to 6 atmospheres. In fact, it could only be properly adapted for one stroke. However, it answered very well for the liquefaction of gases by compression, for which it was intended, and when manual labour was employed; but it is not a practical method for condensing air upon a large scale, and where a steam-engine is employed. The second defect also was greatly diminished by M. Thilorier, in the pumps of both his first and second invention, and consisted in never compressing the gas in one pump beyond a certain extent—say, for the sake of example, 4 atmospheres—as the piston of the next pump (which was one-fourth of the area of the first), being placed on the opposite side of the fulcrum, rose as the first fell, and received the gas from the first pump already compressed into a fourth of its bulk, which in its turn it compressed into one-sixteeenth of its original bulk, and forced into a third pump similarly diminished in size, which again compressed it to 64 atmospheres, and so on. By this arrangement, the resistances of the condensed gas against each piston were equal, and instead of being that of 64 atmospheres at the end of the stroke on the largest pump, only amounted to what was equivalent to three times the pressure of 4 atmospheres on its piston. Of course, the number of pumps, and their relative capacities, were so arranged as to suit the particular amount of condensation required, and only limited by the consideration of the increase of friction attending the employment of a greater number of pumps. The third and fourth defects were also considerably lessened by other arrangements of the same inventor, one of which was having the piston-rods of such size, that the annular space between each and the walls of the cylinder should be to the whole contents of the cylinder inversely as the degree of compression intended to be produced in that pump. The gas was then pressed from one end of the cylinder to the other end, and in the return stroke, from the smaller space of each cylinder, was forced into the larger one of the next, the pumps being diminished in size, as in the former arrangement. By this last method the tendency to leakage was also reduced. Thus, taking the same numbers as before, it was in the first pump 4 pressures -1 pressure; in the second, $16-4$ pressures; and in the third, $64-16$ pressures. Also, the gas was only reduced to one-quarter of its previous volume in each pump; and it also became considerably cooled by the large surface of the piston-rod being exposed to the air at each stroke. The inventions of this gentleman have been of immense service in the compression of different gases to high degrees, and have afforded very valuable information with regard to the latent heat of gases, &c.

The plan of the Baron von Rathen is as follows:—By means of a double-acting pump A, he first compresses air into the stationary reservoirs O O O, P P P, and the locomotive reservoir QQQ, which are all put in communication, and cut off from the pumps B and C. This is continued until the air reaches a density of 4 atmospheres; OOO is then cut off from communication with PPP and QQQ, and connected with the double-acting pump B, the area of whose piston is ¼ that of A, its length of stroke being the same. The piston-rods of the two pumps A and B are connected to cranks at right angles upon the same shaft, and one is at the middle of its stroke while the other is at the end; A then goes on pumping the whole of its

* For a description of these inventions see the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, for the year 1830, page 345. The machine is however well known in London, and may be seen at most of the philosophical instrument shops.

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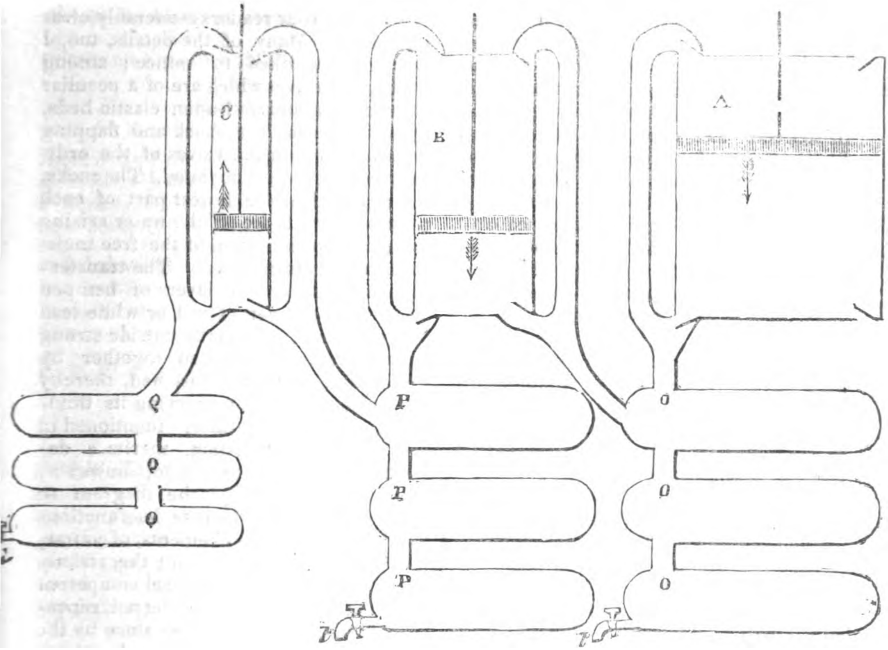

contents, compressed to 4 atmospheres, into OOO, from which B, at each stroke, receives the same quantity, and presses it into PPP, QQQ, until the air in the latter reaches a density of 16 atmospheres; PPP is then cut off from QQQ, and put into communication with C, a pump similar to A and B, with the same length of stroke, but the area of its piston is $\frac{1}{4}$ that of B, or $\frac{1}{16}$ that of A; all the pumps are then attached to a three-throw crank, the arms set at 120° apart, so that when A is at $\frac{1}{3}$ of its down stroke, B is at $\frac{2}{3}$ of its down stroke, and C at $\frac{1}{3}$ of its up stroke. The compression is then carried on as before, B at each stroke pumping into PPP the same quantity of air, at a density of 16 atmospheres, which C receives out of it, and continues in its turn to press air into QQQ, until it has attained a density of 64 atmospheres. After the first operation, OOO and PPP will continue filled with air of 4 and 16 atmospheres respectively. Of course, if QQQ were already filled with air above the density of that in OOO, and less than that in PPP, it would be put into communication with B at once, or even with PPP, only that by this means some loss would take place from the air in PPP expanding until it had filled QQQ without doing work. This loss, however, would be very trifling by having PPP very large compared to QQQ. It will be observed that when A, B, and C are supplying air of 4, 16, and 64 atmospheres respectively, they are each doing the same work; for in A we have 4 pressures on one side, and 1 on the other, and therefore $4-1=3$ unbalanced; in B, we have $16-4=12$ unbalanced; and in C, $64-16=48$ unbalanced; and as the areas of their pistons decrease in the same proportion, the work in each is the same. In the proposed method of locomotion, the air is intended to be compressed to 50 atmospheres, and the locomotive reservoir will always continue filled with air of 5 atmospheres; therefore A and B will always be acting together, and the areas of the pistons will, in order to render the resistance equal in each, diminish in the proportion of 137, 37, and 10, nearly, if 3 pumps only are employed; and this number will probably be found best. In that case, supposing that it will require the two first pumps together to make 87 strokes to fill the

locomotive with air from 5 up to 13·7 atmospheres, it will require the three pumps together to make 363 strokes more to fill it up to 50 atmospheres, so that during nearly the whole process all the benefits of the arrangement would be secured. Let us see what these benefits are. The first of the defects above mentioned will be all but completely cured, as the three-throw crank and fly-wheel together will reduce the inequalities of the work, and enable it to be performed with the quantity of steam necessary to overcome the *average* resistance, and the friction properly so called. With regard to the second defect—the strain on the machinery, it is clear that here (taking 64 as the degree of compression), the pressure at full work in all the pumps being equal, we have only a constant resistance equivalent to that of $4-1$, or 3 atmospheric pressures multiplied into the number of square inches in the largest piston, whereas by the old method we should have encountered a strain of 63 atmospheres upon the same surface. I, of course, except from this the strain upon the body of the pumps, which will be the same in both cases. Thirdly, the tendency to leakage is reduced, as the greatest is $64-16$ atmospheres, instead of $64-1$, as by the common method. Fourthly, the effect of the heat will probably be altogether dissipated, as the greatest compression the air undergoes is to a fourth of its previous volume, and, by employing more pumps, the degree of compression in each may be reduced to any extent; and as it is received in immense reservoirs very freely exposed to the air, which would alone probably supply the following pump with it in a perfectly cool state, but if not, any of the proposed methods by jets of water, and so on, will be immediately effective. Thus, in the last pump the greatest possible heat that could be developed would be that manifested in compressing from 16 to 64, while by the common method we should have all the heat of air suddenly compressed to 64. Those acquainted with the deteriorating effect of heat upon the valves, pistons, &c., quite apart from the additional resistance it creates, will sufficiently appreciate this part of the invention. My desire not to take up too much space in your valuable Magazine, prevents me from enlarging upon the subject; but perhaps sufficient has been said to give your readers a tolerably clear idea of it. Many of the details, too, I should have liked to notice; among others, the valves which are of a peculiar construction, and fall upon elastic beds, by which means the shock and flapping experienced with the valves of the ordinary condenser are obviated. The cocks, *t*, *t*, *t*, placed at the lowest part of each reservoir, are to let off the water arising from the condensation of the free moisture in the atmosphere. The transfer-pipe is made of two layers of hempen cloth, with a layer of red or white lead between them, and on the outside strong metallic rings connected together by screws and chains are fastened, thereby strengthing it and preserving its flexibility. The "moderator," mentioned in my first communication, merits a description; I have preferred, however, merely indicating by the diagram so much of it as would make its functions intelligible. The arrangements, of course, may be greatly varied, but the strictly mechanical parts I do not feel competent to explain, and I have preferred representing them as I have done; since by the removal of all extraneous considerations, the principle is more clearly seen.

I am, Sir, yours, &c.,

x^2.

Postscript.

It may be convenient for reference just to add the calculation for the power required to compress air by the condenser. Let the receiver be of a capacity V cubic feet; the pump of a capacity A cubic feet; its length of stroke, *l* feet; and the area of its piston *s* feet; *p*, the atmospheric pressure upon one square foot; *m* and *m′*, the density of the air in the receiver at the end and beginning of the nth stroke, which we will suppose the pump to be making. Therefore

$$m=\frac{V+nA}{V}, \text{ and } m'=\frac{V+\overline{n-1}\,.\,A}{V}.$$

Now the air will be continually compressed in A until it is of the density *m′*, when it will force open the valve communicating with the receiver, and flow into it, its density increasing from *m′* to *m*. Let *h* be the distance from the end of the stroke at which the valve opens. Then, since the pressure of the air varies inversely as the space it occupies, the pressure of the condensed air against

the piston at any distance x greater than $h = ps\frac{l}{x}$, and the pressure of the atmosphere on the other side $= ps$. $\therefore$ Before the valve opens,

$$\text{Resistance at distance } x = ps\left(\frac{l}{x} - 1\right) \ldots\ldots\ldots\ldots (1)$$

Again, after the valve opens, since at any distance x' less than h, the air which, at a density m', occupied a space $V+sh$, now occupies a space $V+sx'$, we have pressure against piston

$$= ps\, m'\frac{V+sh}{V+sx'},$$

and deducting, as before, the pressure of the atmosphere; $\therefore$ after the valve opens,

$$\text{Resistance at distance } x' = ps\left(m'.\frac{V+sh}{V+sx} - 1\right) \ldots\ldots\ldots\ldots (2)$$

Now, by integrating (1) between $x=l$ and $x=h$, we get

$$\text{Power until valve opens} = ps\left(l \log._{\varepsilon}\left(\frac{l}{h}\right) - l + h\right) \ldots\ldots\ldots\ldots (3)$$

And integrating (2) between $x=h$ and $x=o$, we get

$$\text{Power after valve opens} = ps\left(m'\frac{V+sh}{s}.\log._{\varepsilon}\left(\frac{V+sh}{V}\right) - h\right) \ldots. (4)$$

$\therefore$ adding (3) and (4) together, we get

$$\text{Power during the nth stroke} = p.\left\{sl\log._{\varepsilon}\left(\frac{l}{h}\right) + m'.(V+sh)\log._{\varepsilon}\left(\frac{V+sh}{V}\right) - sl\right\}$$

Or, observing that $sl = A$; that $\frac{l}{h} = m'$, and substituting the values of m and m', we get power during nth stroke,

$$= p.V.\left\{\frac{V+nA}{V}.\log._{\varepsilon}\left(\frac{V+nA}{V}\right) - \frac{V+\overline{n-1}.A}{V}\log._{\varepsilon}\left(\frac{V+\overline{n-1}.A}{V}\right) - \frac{A}{V}\right\} \ldots. (P.)$$

Now, if we give n the values 1, 2, 3, $\overline{n-1}$, $\overline{n-2}$, n, in succession, we see that the 2nd term of each such expression is the same as the first of the succeeding one with the sign changed; therefore, upon adding together the power for the 1st, 2nd, 3rd...nth strokes, we get

$$\text{Power during n strokes} = p.V.\left\{\frac{V+nA}{V}\log._{\varepsilon}\left(\frac{V+nA}{V}\right) - \frac{nA}{V}\right\} \ldots. (Q.)$$

[If in these two formulæ, (P) and (Q), we again substitute m for $\frac{V+nA}{V}$; m' for $\frac{V+\overline{n-1}A}{V}$; and 15×144 lbs. for p, we get power to fill a reservoir of V cubic feet from density m' to density m

$$= 15 \times 144 \times V.\left\{m \log._{\varepsilon} m - m' \log._{\varepsilon} m' - (m - m')\right\} \text{ lbs. raised 1 foot,}$$

and power required to fill it from a density 1 to a density m

$$= 15 \times 144 \times V.\left\{m.\log._{\varepsilon} m - \overline{m-1}\right\} \text{ lbs. raised 1 foot,}$$

which are the same expressions as I have assumed in the above calculations, and the same as are obtained from the more simple method of determining them.

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RETROSPECT OF THE PROGRESS OF STEAM NAVIGATION.—CONTINUED FROM P. 22.

[From the Address of Sir John Rennie, President of the Institution of Civil Engineers to the last Annual General Meeting.]

From this period nothing remarkable appears to have occurred, until the construction of the *United Kingdom*, which was by far the largest in size and the most powerful that had been made. She was 160 feet long, 26½ feet beam, and 200 horses power; the vessel was built by Steele, of Greenock, and the engines by David Napier. As deep sea navigation by steam advanced, it became an object of considerable importance to save fuel, and to obviate the inconvenience of the incrustation of the boilers by the deposit of salt, and other sediments occasioned by the use of sea water: David Napier therefore introduced the system of surface condensation, the condenser being made of a series of small copper tubes, through which the steam, after being used, passed from the cylinder to the air-pumps, the pipes being surrounded by a constant supply of cold water, so that the steam was condensed and the water was returned directly back into the boiler, to be again converted into steam, without the admixture of salt water according to the usual plan, thus employing the same fresh water over again, whereby the above-mentioned inconvenience of incrustation of the boilers was in a great measure avoided. Hall afterwards tried the same system with certain modifications, and it was employed in several vessels; but like Watt, Cartwright, and others who had tried it, he found the condensation was not so complete, and the weight, and cost, and the difficulty of keeping the apparatus in order, has hitherto prevented it from being generally used; for although it possesses advantages in many respects, still upon the whole they do not counterbalance the disadvantages, and the old system of condensation by jet, with the aid of the brine pumps, is more generally employed. The brine pumps and refrigerators were invented and patented by Maudslay and Field in 1825, and were used on board the *Enterprise*. After the *United Kingdom*, numerous vessels of similar and even greater size were constructed to ply between London and Leith, Glasgow and Liverpool, and elsewhere.

The next great step in advance was the crossing the Atlantic. This had long been in agitation, and was freely discussed by numerous enterprising minds, anxiously bent upon working out the fulfilment of such a desirable and important object; but the great practical difficulties involved in the execution were not so easily overcome.

To construct a vessel of sufficient size, with engines of adequate power to propel her through the storms of the Atlantic, and carrying with her sufficient fuel to keep the engines in motion, was considered by many (and among them were very competent authorities) to be extremely doubtful, but by the world in general the task was considered to be wholly impracticable. To Bristol is due the origin of this great undertaking, and a company of enterprising individuals, with Brunel as their consulting engineer, was formed for that object; it was, however, with difficulty that they found engineers to carry it into effect, some of the first constructors of the day having declined to undertake it. Messrs. Maudslay and Field, however, who had already taken such a prominent part in the prosecution of steam navigation, saw their way, and boldly engaged to construct engines of the requisite power, well adapted for the purpose. Accordingly a vessel, called the *Great Western*, was designed by Patterson, and built by him at Bristol; and the engines were completed and fitted on board in March, 1838. The vessel was 210 feet long, and 38 feet beam, drawing 15 feet when laden, being 1240 tons burthen, and capable of carrying 500 tons of coals, which it was calculated would last twelve days. The engines were upon the side-lever principle, each of 210 horses power, with cylinders 73 inches diameter and 7 feet stroke, making 15 strokes per minute; they were fitted in cast-iron frames, with the latest improvements. The boilers were constructed with the flues over the fires; they were called double-story boilers, and have been since much used; they had brine pumps, and were worked under a pressure of 5 lbs. per square inch; the total weight of the engines and boilers, including the water and the paddle-wheels, was about 420 tons. The vessel was completed with her engines, and made her first trial on the Thames in March, 1838, realizing 12 miles per hour. On Sunday 8th April, she started on her first voyage from Bristol, under the command of Captain Hosken, with seven passengers, and a cargo of 50 tons of goods, besides 500 tons of coals, and reached New York on Monday, 23rd of April, a distance of 3000 miles, in thirteen days and ten hours. Her arrival created the greatest interest; the quays were crowded with spectators, anxiously waiting to give a hearty welcome to the enterprising and successful adventurers, who had thus so triumphantly solved the grand problem, and had brought the New World within a few days' sail of the Old. On her return she left New York on the 7th May and reached Bristol on the 23rd,

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with 70 passengers; performing the voyage in 15 days. The success of this voyage across the Atlantic having exceeded the most sanguine expectations of its promoters, and indeed of the whole world, there seemed no bounds to the extension of steam navigation; other companies were projected, and numerous larger and more powerful vessels were designed, in equal confidence of success; then followed the *British Queen*, by Napier, of 500 horses power, the *Liverpool*, of 500 horses power, and the *President*, of 600 horses power, whose melancholy fate served for a time to damp the ardour of speculation. The practicability of steam communication across the Atlantic having thus been established, and its superiority over the old sailing system being clearly proved, time only was necessary to render it perfect. The line from Liverpool to Boston was then designed, and carried into effect by Cunard, for conveying the mails; it consisted of four fast vessels, the *Acadia*, *Caladonia*, *Hibernia*, and *Cambria*, of about 1000 tons and 450 horses power each. This was followed by the gigantic project of the Royal Mail Company, for carrying the mails between England and the West Indies, consisting of twelve vessels, each of about 1200 to 1300 tons burthen, and 420 horses power. The engines of these vessels resembled very much those of the *Great Western*, whose complete success induced their being taken as models for others. The great weight and space occupied by these engines, being upon the average about a ton for every horse-power, rendered it difficult for them to carry any great amount of cargo beyond the passengers, and thus the profits as a mercantile speculation were materially lessened; it became extremely desirable, therefore, to ascertain whether engines, equally efficient, could not be made of less weight, and to occupy considerably less space.

In order to effect this object, engines were invented, by which the power was applied directly from the piston to turn the paddle-wheel shaft, without the intervention of side levers; these were called direct-acting engines, and at first great objections were made to them in consequence, as was asserted, of the loss of power arising from the obliquity of the action of the piston-rod upon the crank on the paddle-wheel shaft. Messrs. Seaward were among the first to introduce this system into the *Gorgon*, and notwithstanding the objections above stated, it has been improved by them and by other engineers, and has materially gained ground. The obliquity of action of this system, compared with that of the side-lever system, can only be considered in the light of a little extra friction, which is fully, if not more than compensated for, by the reduction of weight and space. The modifications of the system by Miller have been very successful, and, combined with the forms of vessels adopted by him, have enabled great speed to be attained both by sea-going vessels, and his boats on the Rhine and other rivers. Even the objection of extra friction, however, if tenable, is obviated by the vibrating cylinders described in Trevithick and Vivian's patent in 1802; patented by Witty in 1813, and by Manby in 1821, by whom the first engines of the kind were constructed; subsequently improved by Maudslay and Field, and Spiller; and now extensively manufactured by Penn, Miller, and others; Maudslay and Field's double cylinder engines, so arranged that a long connecting rod is obtained by its being enabled to descend between the cylinders; the Trunk engine by Humphery; and the modification of the concentric cylinders by Joseph Maudslay; as well as other varieties of this system by different makers. The substitution of wrought-iron for cast in a large portion of the frame and condensers; the tubular instead of the common flue boiler, first proposed by Blackley in 1764, and afterwards improved in the locomotive boiler, and introduced into steam vessels by Maudslay, Spiller, Bramah, and others about the year 1829, as well as the use of steam of higher temperature and increased expansive action, have combined materially to increase the effect of the engines, and reduce the consumption of fuel; so that the space and weight occupied by them is now reduced to nearly one-half what it was originally, or, in other words, engines of double the power now only occupy the same space and tonnage in the vessel; thus a material advantage has been gained in enabling vessels to carry a larger quantity of fuel, by which they can extend their voyage; and greater power is rendered disposable for propelling the vessel through the water. As economy of time becomes daily more important, every means which can effect it are brought into operation, and thus the power of the engines has been continually augmented, in order to produce greater speed and shorten the duration of the voyages. Referring to the navy, we find, that, in 1822, 80 horses power was the largest; in 1827, 160 horses power; in 1828, 200 horses power; in 1830, 220 horses power; in 1838, 440 horses power; and in 1845 we have the *Retribution* and *Terrible*, with nearly 1000 horses power in each, and it is not improbable that, ere long, greater power will be employed.* Whilst the royal steam navy

* The total amount of steam power employed in the Royal Navy is about 35,000 horses power.

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has been making such rapid progress, the mercantile steam navy has not only kept pace with it, but has even led the way; for the enterprising, commercial spirit of this country is ever on the alert; every improvement is seized upon with avidity, and the greatest inducements are held out to make new discoveries; in fact, nothing but constant progress can satisfy the restless spirit of improvement. In the infancy of the art, we were satisfied with five or six miles per hour; now, when we have attained above 17 miles per hour, we are confidently looking to a still greater result.

Whilst the improvements, above described, have been making in the engines and in the mode of applying them, various attempts have been made to obviate the inconvenience and loss of power occasioned by the concussion of the floats of the ordinary paddle-wheel entering the water, as well as the heavy drag or back action of the water when the floats leave it; numerous experiments and inventions have been tried for constructing a wheel, of such a form that the floats shall always enter the water in the most advantageous manner, and having effected the object, shall leave it again with the least resistance. To describe the numerous inventions of this kind would be foreign to my purpose, and would occupy too much of your time; it will suffice to mention that of Buchanan, by which the floats always enter and depart from the water perpendicularly; those of Cavé, Oldham, Morgan, Perkins, Seaward, and Barnes, which are modifications of it, differing chiefly in the angle at which the floats enter and leave the water, and the mechanism attached to the wheel by which the motion is communicated to the float-boards; the principle of this invention is extremely good, but in practice it has unfortunately been found, that the wheels of this construction, after a little use, are liable to get out of order; it is not therefore generally adopted, although, whilst they are in order, considerable advantage is doubtless gained. To obviate this inconvenience, as well as that of the common wheel, Field invented what is technically termed the Cycloidal Wheel; this consists in dividing each float board into several parts or narrower boards, and arranging them so nearly in cycloidal curves that they shall all enter the water at the same place in immediate succession; as the acting force of each board is radiating, it propels whilst passing under the water in the ordinary way, and when it emerges, the water escapes simultaneously from each narrow board; this principle was not followed up by its inventor, and was afterwards patented by Galloway, since which it has been very generally adopted. The principle of reefing the paddle-wheels is also used, so that when the vessel is deeply immersed, the leverage of the paddles can be shortened, and when light, it can be lengthened, and can thus be always adjusted to the power of the engines.

As economy of fuel is an object of the greatest importance, so in long voyages it is advisable to employ the wind as a moving power, as much as possible, when favourable; it became therefore desirable to contrive a simple means of detaching the paddle-wheels from the engines, so as to allow them to turn round with the motion of the vessel through the water, and thus to prevent them from impeding her way; various contrivances of this kind have been invented, but one of the most simple, and which is now much employed, was invented by Braithwaite and Milner; it consists of a friction clutch attached to the paddle-shaft, which, by means of keys and screws, can be tightened or slackened with facility, and thus the paddle-wheel is attached or released at pleasure. Numerous attempts have been made to introduce the rotative engine without pistons, but they have hitherto not been successful.

The great results rendered by steam navigation induced the mechanical world to turn their attention towards the extension and improvement of it; Boulton and Watt, Maudslay, Field, Robert and David Napier, Jessop, Glynn, Barnes, Miller, Ravenhill, Girdwood, Manby, Spiller, Scott, Sinclair, Caird, Todd, Fawcett, Bury, Forester, Seaward, Penn, Fairbairn, Hall, Rennie, and numerous other able men devoted their minds to it, and have produced some splendid examples of engines and mechanism in that department. When we look back to Symington's original engine, in 1788, it appears to have been so changed as scarcely to be recognisable as the same, and from a speed of 5 to 6 miles an hour in smooth water, we now find that a speed of 8 and 9 miles an hour against a heavy gale and head wind in the Atlantic, and above 17 miles in still water, has been obtained, whilst improvements are in progress which lead us to anticipate at no very distant period far greater results; much of this, no doubt, is due to the perfection of the workmanship, as well as to the more correct proportions and adaptation of the various parts of the machinery, compared with what was formerly done, and which it was impossible to accomplish with the slender and inefficient means then at command; for this we are greatly indebted to the improved self-acting tools of Whitworth, Fox, Lewis, Sharpe, Roberts, Nasmyth, and others. The

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improvements in the form and construction of the vessels have also contributed much; and in the investigation of this difficult subject we are much indebted to John Wood, Oliver Lang, Fearnall, Fincham, Ditchburn, Symonds, Rule, Seppings, Scott, Russell, Edye, Patterson, White, Pasco, and others.

Great as has been the result of steam-navigation under the paddle-wheel system, still as perfection is approaching, it cannot be denied, that it has several disadvantages when applied to sea navigation during stormy weather, which it is most desirable to obviate. Paddle-wheels act to the greatest advantage in smooth water and upon an even keel. The unequal immersion of the paddle-wheels during the rolling of the vessel, in a heavy sea, prevents that uniformity in the action of the engines, which is necessary to insure their greatest effect, and although this may be lessened, to a certain degree, by the use of mechanical or feathering wheels, as I have already stated, the complexity of their construction is objectionable. The resistance, offered by the paddle-boxes to the wind, in addition to their top weight, has a sensible influence in diminishing the speed and effect of the engines, and in ships of war, the great space occupied by the wheels on the broadsides of the vessels, materially interferes with the efficiency of the batteries; moreover, the wheel, as the principal propelling agent, being constantly exposed to shot, is under very considerable risk of having its efficiency impaired. The idea, therefore, of substituting for it some other propelling agent, had long been a favourite object of investigation amongst engineers. The origin of this, like every other great invention, is very difficult to be ascertained with accuracy, as the same idea not unfrequently occurs at the same time to different individuals, totally unconnected with each other. The first idea of stern-propelling was very probably suggested by the movement of fishes, whose chief propelling power exists in the tail, as also from the common and ancient practice of sculling a boat from the stern. A rude idea of stern-propelling is attributed to Duguet in 1727, but it was so totally different from the system now employed, that it can scarcely be called the same invention. His system consisted of two boats, connected together by two cross beams with a screw, inserted between the boats; this double boat was moored to a post in the river, and the current, acting upon the screw, turned it round, this motion thus generated, was communicated over pulleys, to which were attached the vessels to be drawn along; this plan may be likened to the effect of a water-wheel, or any other fixed first mover; still there is an idea of the screw, which, if pursued, might have been converted into screw-propelling. In 1768, Painton proposed the pteraphore to be applied to the bow and stern and sides of a vessel horizontally, but does not describe how it was to be moved. Lyttelton also proposed a screw-propeller in 1794. The first practical experiment, however, appears to have been made by Shorter in 1802, with a propeller like the sails of a windmill, applied to the stern of a vessel in the Thames. He afterwards tried several propellers, particularly in the *Superb* line-of-battle ship in Gibraltar Bay, worked by a screw by the intervention of the capstans, by which the vessel was moved through the water at the rate of about 2 miles an hour.

Shorter does not describe the kind of propeller used in this experiment, although Napier, who afterwards proposed a similar plan without knowing what had been done, when he accidentally found Shorter, had from him an account of his experiments, and saw a large collection of propellers applicable to the bow, stern, sides, and every part of the vessel: Napier acknowledged and admitted that Shorter had conceived almost every possible kind of arrangement, and that his models and plans comprised most of the systems since made public by different parties; Shorter also exhibited several experiments with different propellers, and attributed the best results to a propeller with a single blade projecting from the axis. In 1824, a work was published under the direction of the French government, describing the several modes of propelling in use in America, on the principle of the screw; one plan was to have a hollow in the bottom of the vessel nearly as long as the vessel itself, with a screw revolving in it to produce motion forwards or backwards; another form of this system was to have a double screw between two boats. In 1825, a company was formed for applying Brown's gas-vacuum engine to navigating boats on canals, and a premium was offered for the best invention for propelling boats without paddle-wheels. In 1827, the ingenious and indefatigable Tredgold, in his work on the steam-engine, described and investigated the theory of screw-propelling; about the same time, or perhaps rather before, Brown, the inventor of the gas-vacuum engine, proposed to apply a propeller, consisting of two blades placed at an angle of about 90° to each other and 45° to the axis; this was intended to be placed in the front of the bow of the vessel, and attached to a shaft working through a stuffing-box, which could be raised or lowered at pleasure. He obtained the premium of the

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Canal Towing Company for this, and they determined to pursue the subject further; in furtherance of this object, they built a vessel at Rochester with a gas-vacuum engine of 12-horses power, which was applied to working Brown's propeller by means of bevel gear; the result of this experiment does not exactly appear, although it was considered sufficiently satisfactory for Brown to continue his investigations: he accordingly built another boat with similar engine and machinery, and made several experiments with it on the Thames, near London, when he is said to have attained the velocity of 7 miles an hour with it. Subsequently, Cummerow, Woodcroft, Lowe, Ericsson, and others pursued the subject and took out patents for various modifications of screw-propelling; nothing, however, was materially effected until the year 1836, when T. P. Smith obtained a patent for the application of a screw to propel vessels, by placing it in that part of the stern of the vessel called the "dead wood." He accordingly built a small vessel, and made numerous experiments with her on the Thames; this little vessel was 34 feet long, 6 feet 6 inches beam, and drew 4 feet water; in it he placed a small high-pressure engine, with a cylinder 6 inches in diameter, and 15 inches stroke, which was applied to working a screw 2 feet diameter, having a pitch of 2 feet 5 inches. With this vessel he obtained a speed of from 7 to 8 miles an hour; he then tried her on the sea between Ramsgate and London, and she answered very well in driving against the wind in a heavy sea. Upon the success of this experiment a Company, called the Ship-Propelling Company, was formed, Smith being their adviser, and under his directions a vessel, called the *Archimedes*, of 232 tons burthen, was built in London by Wimshurst; she was 125 feet long, and 21 feet 10 inches beam, having a draught of water of between 9 and 10 feet; she was propelled by a pair of engines of the united force of 80 horses power. The engines and machinery, which were made by Messrs. Rennie, instead of being placed transversely in the vessel as was usual in paddle-wheel steam-boats, were placed longitudinally; these engines were upon the direct-acting principle, and their power was applied to work the shaft upon which the propeller was placed, by means of two spur-wheels with teeth of hornbeam wood, and two pinions with iron teeth working into each other, the motion of the propeller shaft being 5·33 to 1; or, in other words, when the engine made 25 strokes, the propeller made 133·3 revolutions. The propeller, which was in the dead wood, was united to the shaft, by means of a water-tight stuffing-box passing through the stern of the vessel. The propeller at first consisted of a single-threaded screw: but this not answering so well, another screw was employed, with two threads opposite to each other, 5 feet 9 inches diameter, and 8 feet pitch. The *Archimedes* obtained a velocity of 9 miles per hour through the water, and proved herself an admirable sea-boat, going head to wind in a heavy sea, and she established beyond all doubt the success of the invention, and its superiority over paddle-wheels in many cases; still, however, much remained to be done before prejudice could be overcome, and before the system could be brought to such perfection as to compete in velocity successfully with paddle-wheels, which had so long and so completely engrossed the public attention as scarcely to leave an opening for any other system; latterly, however, screw propelling has made considerable progress. In 1842, the *Bee* was constructed by Maudslay and Field for the Government; she was worked by a steam-engine of 10 horses power, adapted for driving either the screw or the paddle-wheel in the same vessel, and thus to try the comparative merits of the two systems. From the trials and experiments made with the *Bee*, it appeared, that upon the whole the paddle-wheels had an advantage as to speed under all circumstances. In 1840, the *Dwarf*, of 210 tons burthen, which was the first screw vessel ever commissioned in the British navy, was constructed by Messrs. Rennie; the engines, of 120 horses power, upon the direct-action principle, were attached to two spur-wheels, with two pinions for working the screw upon the propeller shaft, on the same plan as the *Archimedes*. The *Dwarf* proved herself an excellent sea-boat, and attained a speed of 12¼ miles per hour through still water. The *Rattler* was the second screw-propelling vessel introduced into the navy. She was 176 feet long, and 32 feet 8 inches beam; drawing 11 feet 3 inches water, carrying 20 guns, and was about 888 tons burthen. The engines, of 200 horses power, were by Messrs. Maudslay and Field; and her screw, which was 10 feet diameter, and 11 feet pitch, was driven by cog-wheels; the screw made 103 revolutions per minute, being in the proportion of 4 to 1 of the speed of the engines; her velocity through still water was 9½ miles per hour, and she proved a good sea-boat. All these have been surpassed in speed by the royal yacht, the *Fairy*, built for Her Majesty, by Ditchburn, with engines by Penn; she is 260 tons burthen, with two oscillating engines of the united force of 125 horses power, driving one spur-wheel and one pinion; the screw consists of two blades, and makes 250 turns per minute,

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being in the proportion of 5 to 1 of the moving power. The speed of the *Fairy* is 15¾ miles per hour through the water. The merits of the screw system have now been so completely tested, that the Government have determined to introduce it more generally into the navy, particularly for guard-ships; these vessels are to be of two classes, line-of-battle ships and frigates; the former having combined engines of 550 horses power, the latter 350 horses power; the cylinders of the engines will, in some cases, be applied horizontally, and the pistons will act directly upon the propeller shafts, by cranks, without the intervention of wheels; the propeller shaft will make from 50 to 60 revolutions per minute, and the speed of the vessels will be from 5 to 7 miles an hour; this velocity will be sufficient to enable them to command their own position; and with heavy guns and the free uninterrupted use of their batteries, they will be fully equal to cope with any vessels of their class. The *Amphion* frigate is also being fitted with a screw propeller, to move with a greater velocity than the guard-ships. She is 1290 tons, was originally built for sailing, and carries 36 guns; she is propelled by a screw of two blades, 15 feet diameter, and 21 feet pitch, driven by a pair of engines of 300 H.P., making from 45 to 50 revolutions per minute; her speed on trial was 7 knots an hour, and promised more; the whole was designed and executed by Messrs. Miller and Ravenhill. To Miller the constructive portion of marine engineering owes much; the forms of framing, the graceful proportions, and scientific combination of strength with lightness; the arrangement of the several working parts of the engines, so as to diminish the weight, and increase their compactness, without impairing either efficiency, have produced the natural consequences, not only in the fast river boats on the Thames and the Rhine, and other rivers where peculiarities of construction were specially demanded, but also in the sea-going vessels, for the mercantile as well as for the Royal Navy, and the post-office service of both France and England.

THE CENTRAL SUN.

At the close of the last meeting (December 14) of the Royal Irish Academy, Sir William Hamilton announced that he had just received from Professor Mädler, of Dorpat, the extraordinary and exciting intelligence of the presumed discovery of a central sun. Professor Mädler's essay on the subject (*Die Central Sonne*, Dorpat, 1846,) was also exhibited by Sir William Hamilton on the same evening to several members of the academy. By an extensive and laborious comparison of the quantities and directions of the proper motions of the stars in various parts of the heavens, combined with indications afforded by the parallaxes hitherto determined, and with the theory of universal gravitation, Professor Mädler has arrived at the conclusion that the Pleiades form the central group of our whole astral or sidereal system, including the Milky Way and all the brighter stars, but exclusive of the more distant nebulæ, and of the stars of which those nebulæ may be composed. And within this central group itself he has been led to fix on the star Alcyone (otherwise known by the name of Eta Tauri,) as occupying exactly or nearly the position of the centre of gravity, and as entitled to be called the central sun. Assuming Bessel's parallax of the star 61 Cygni, long since remarkable for its large proper motion, to be correctly determined, Mädler proceeds to form a first approximate estimate of the distance of this central body from the planetary or solar system; and arrives at the (provisional) conclusion, that Alcyone is about 34,000,000 times as far removed from us, or from our own sun, as the latter luminary is from us. It would, therefore, according this estimation, be at least a million times as distant as the new planet of which the theoretical or deductive discovery has been so great and beautiful a triumph of modern astronomy, and so striking a confirmation of the law of Newton. The same approximate determination of distance conducts to the result that the light of the central sun occupies more than five centuries in travelling thence to us. The enormous orbit which our own sun, with the earth and the other planets, is thus inferred to be describing about that distant centre, not indeed under its influence alone, but by the combined attraction of all the stars which are nearer to it than we are, and which are estimated to amount to more than 117,000,000 of masses, each equal to the total mass of our own solar system, is supposed to require upwards of 18,000,000 of years for its complete description, at the rate of about eight geographical miles in every second of time. The plane of this vast orbit of the sun is judged to have an inclination of about 84° to the ecliptic, or to the place of the annual orbit of the earth; and the longitude of the ascending node of the former orbit on the latter is concluded to be nearly 237°. The general conclusions of Mädler respecting the constitution of the whole system of the fixed stars, exclusive of the distant nebulæ, are the following:—He believes that the middle is indicated by a very rich group (the Pleiades), containing

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many considerable individual bodies, though at immense distances from us. Round this he supposes there is a zone, proportionally poor in stars, and then a broad, rich, ring-formed layer, followed by an interval comparatively devoid of stars, and afterwards by another annular and starry space, perhaps with several alternations of the same kind, the two outmost rings composing the two parts of the milky way, which are confounded with each other by perspective in the portions most distant from ourselves. Professor Mädler has acknowledged in his work his obligations, which are those of all inquirers in sideral astronomy, to the researches of the two Herschels, Sir William and Sir John. The views of Sir William Herschel respecting the relation of our solar system to the milky way, will naturally recur to the recollection of our readers; and while astronomers are anxiously awaiting the shortly-expected appearance of the complete account of Sir John Herschel's observations on the southern nebulæ, the following passage of a letter, which was written in 1835 by that illustrious son of an illustrious sire, from the Cape of Good Hope, to Sir William Hamilton, may be read with peculiar interest, from the agreement between the views it expresses and some of those to which Professor Mädler has been led. In the letter just referred to (from which an extract was published at the time) Sir John Herschel expressed himself as follows:

"The general aspect of the southern circumpolar region, including in that expression 60° or 70° of S. P. D., is in a high degree rich and magnificent, owing to the superior brilliancy and larger development of the milky way; which, from the constellation of Orion to that of Antinous, is one blaze of light, strangely interrupted, however, with vacant and almost starless patches, especially in Scorpio, near *a* Centauri and the Cross; while to the north it fades away pale and dim, and is in comparison hardly traceable. I think it is impossible to view this splendid zone, with the astonishingly rich and evenly-distributed fringe of stars of the third and fourth magnitudes, which form a broad skirt to its southern border, like a vast curtain, without an impression, amounting to a conviction, that the milky way is not a mere stratum, but an annulus; or, at least, that our system is placed within one of the poorer and almost vacant parts of its general mass, and that eccentrically, so as to be much nearer to the parts about the Cross than to that diametrically opposed to it."—

Dublin Evening Post.

LIST OF ENGLISH PATENTS GRANTED BETWEEN DEC. 31, 1846, AND JAN. 7, 1847.

John Clegg, of Oldham, Lancaster, machinist, for improvements in looms for weaving. January 7; six months.

Moses Poole, of London, gentleman, for improvements in fish-hooks. (Being a communication.) January 7; six months.

Samuel Burrows, of Sheffield, York, manufacturer, for certain improvements in the manufacture of knives. January 7; six months.

Pierre Louis Thimote Thiers, of No. 40, Passage Choiseul, Paris, for an improved instrument for drawing off the milk from the breasts of women, and for raising and protecting the nipple both before and after childbirth. January 7; six months.

Charles Runhold Lothman, of Craven-street, Strand, chemist, for improvements in the manufacture of white lead. January 7; six months.

By H. M. Royal Letters Patent.

Brown & Co.'s Patent Metallic Steam Plate, upon a Self-adjusting Principle,

PRESENTS the only perfect mode of applying to Metallic surfaces a uniform heat of any temperature to 400 degrees and upwards of Fahrenheit, with certainty, safety, and economy. The trades and operations requiring particular degrees of heat for some delicate process, are varied and numerous; and every individual who has suffered frequent vexatious losses in spoiled goods, or materials, resulting from its unequal application, will be able to appreciate the value of a large even surface, with a temperature which may be maintained for any period, and so nicely regulated to any required degree, that the most inflammable substances may be securely dried upon it. For drying purposes, Forming Extracts, Essential Oils, and Chemical Compounds, the rapid Evaporation of Fluids and Fluid Substances, the Concentration or Solution of Salts, Sugar, &c., the *Patent Steam Plate* is confidently recommended, and may be seen in operation on Mondays, Wednesdays, and Fridays, at the Office of the Patentees, No. 12, Mark-lane.

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Mechanics' Magazine,

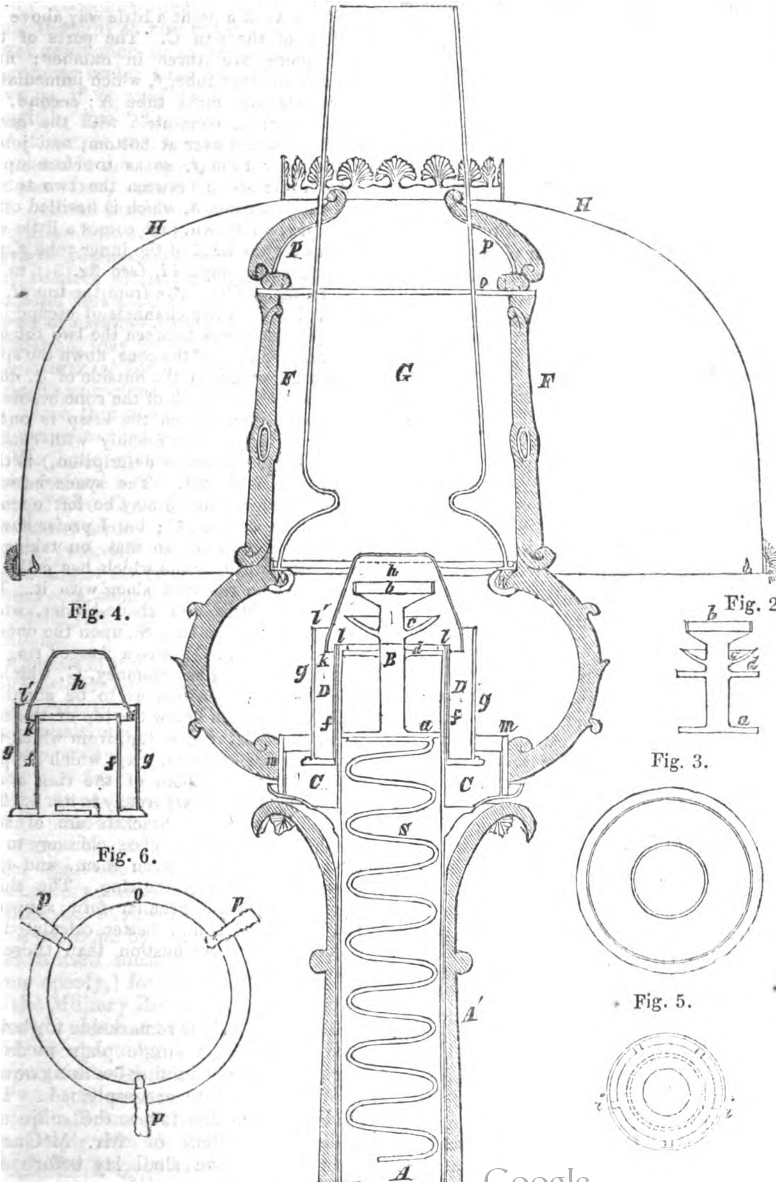
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1223.] SATURDAY, JANUARY 16, 1847. [Price 3*d.*

Edited by J. C. Robertson, 166, Fleet-street.

M'GARY'S PATENT CANDLE LAMP.

Fig. 1.



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M'GARY'S PATENT CANDLE LAMP.

[Patent dated July 6, 1846; Specification enrolled January 6, 1847. Patentee, Mr. Wm. M'Gary, of the firm of Messrs. Brook, M'Gary and Co., Bunhill-row.]

VARIOUS contrivances have been invented for remedying the principal defect incidental to candle lamps—namely, the accumulation of the waste from the candle around the nosle and stool, which, if it cause not obstruction to the action of the spring on which the stool rests, is ever at least uncleanly and unsightly. But in none have we seen this objection so entirely obviated as in the lamp which forms the subject of the present patent. From whatever source the waste may come, and in whatever direction it may be thrown off—whether it be grease from the body of the candle, or ash from the wick, and whether it fall inside or outside of the nosle—there is an ample receptacle provided for it, which prevents it from interfering with the action of the spring, or soiling in the least the visible parts of the lamp, and from which receptacle it can at any time be readily removed by the application of a little heat. Besides this great advantage, Mr. M'Gary's lamp possesses some other peculiarities, which will be found stated in the following description of the details of its construction, which we extract from the inventor's specification:

Fig. 1 is a sectional elevation of the principal portions of the lamp. A^1 is the pillar of the lamp; A is the inner tube which holds the candle; B, the stool, (shown separately in fig. 2,) which rests by a disc, *a*, of a diameter somewhat less than the inner diameter of the tube, on a spiral spring, S; *b* is the candle-socket; *c*, a flange, which projects from the stem of the stool, a little way beneath the socket *b*, and is intended to receive any grease which may run down the sides of the candle and over the socket; *d* is a disc, of nearly the same diameter as A, which serves to intercept such of the grease as may fall over from *c*, and prevents it from reaching the spring S. When the candle has burnt out, and the spring S is in its most expanded state, as represented in fig. 1, the parts *b* and *c* of the stool are both above the top of the tube A, and the part *d* is immediately under the top flange *t*, so that ready access can be had to all these parts, in order to free them from any adhering grease. C is a waste-pan attached to the tube A. A plan of the lamp, on a line drawn through this pan, is given in fig. 3, D is a nosle-piece, of which an elevation and top plan are given separately in figs. 4 and 5, which fits by a bayonet-joint on to the tube A, at a point a little way above the bottom of the pan C. The parts of this nosle-piece are three in number; first, there is an inner tube, *f*, which immediately surrounds the main tube A; second, an outer tube, *g*, concentric with the other, which is turned over at bottom, and joined to the inner tube *f*, so as to close up at bottom the space between the two tubes; and third, a cone, *h*, which is bevilled off at the apex, as shown, and comes a little way down over the head of the inner tube *f*, and is attached by stays, *i i*, (see fig. 5,) to the outer tube. The waste from the top of the candle has thus two channels of escape into the space or recess between the two tubes—one on the inside of the cone, down the space *k*, and the other on the outside of it, down the space l^1. All risk of the cone becoming fixed with grease when the lamp is out of use, (as happens commonly with candle-lamps of the ordinary description,) is thus completely obviated. The space between the two tubes *f* and *g* may be left open at bottom to the pan C; but I prefer having it closed at bottom, so that, on taking off the nosle, all the waste which has collected there may be removed along with it. F is a movable glass and shade-holder, which fits by the bottom ring, *m*, upon the outside of the waste-pan C; *n* is a flanged ring for supporting the glass chimney, G, which is fixed in such a position as to be about an eighth of an inch below the top of the cone *h*; and *o*, a flat ring at top, from which rise three angular brackets, *p p p*, which support the shade H. A plan of the ring *o* and brackets *p* is given separately in fig. 6. The spaces between the brackets are of such width as to allow the glass chimney to be slipped easily in between them, and then passed down through the ring. The chimney glass is of the peculiar form shown in fig. 1, which I find better calculated to ensure perfect combustion than those in common use.

The shade (H) is remarkable for being blocked out of a single plain piece of paper without any joining—a thing never, we believe, before accomplished. The mode of doing this forms the subject of a distinct portion of Mr. M'Gary's patent, which we shall lay before our readers in a subsequent Number.

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THE COLLEGE FOR CIVIL ENGINEERS.—(CONTINUED FROM P. 33.)

It will be remembered by our readers, that we have several times during the past year adverted to this institution, and commented on the varied "phases" which its brief existence has assumed. The first "Resident-director," Colonel Jackson, thought it becoming in him to do what gentlemen in general do not think becoming under such circumstances—to give us, if we may speak in plain, vulgar English, the "lie direct." It turned out, however, that Colonel Jackson never officiated in that capacity, having been, as he considers, ousted by the intrigues of "a gallant brother officer." Into the disputes between these gentlemen we have no inclination to enter; but such of our readers as may be curious in such matters, and especially interested in the views of Colonel Jackson on engineering education, may be referred to a paper in the ARTIZAN for June last. We shall, indeed, ourselves have occasion before we close this article to make a specific reference to that production.

We have given, in something more than general terms, a view of the condition of the College for Civil Engineers under the directorship of Colonel Hutchinson, (vol. xliv. pp. 236, 322–6,) and especially of the absurd system of professional education, and the then reckless blackguardism of the great body of the students.

Colonel Hutchinson had rendered himself not only odious to the more respectable professors by his coarse dogmatism, but unpalatable to the council itself. As to the students—as is always the case where vicious license is permitted by such authority—their dislike towards him amounted to open defiance. Amongst the malcontents was the Chaplain, (the Rev. J. R. Page,) and he took a very active and leading part in the cabals that were formed (for everything *then* was done by cabals, even that which was in itself most fit and proper to be done openly,) for obtaining the dismissal of the Military Resident-director. It was brought about at last somewhat suddenly and unexpectedly, and the council was unprepared with a successor. The history of this *soi-disant* "resignation" is not of sufficient moment to detain us, and we simply remark that Mr. Page supplied the place of resident director as *locum tenens* till a successor to the Colonel could be found. This was no easy matter; and Mr. Page was allowed to fill the offices of Director and Chaplain—and though we believe he was never actually constituted director, he assumed the title and exercised its functions for some time. His direction, however, was far from correcting the evils which existed under his predecessor. In fact, to use a common remark of the time, he "was brought into office on the shoulders of the students." Having been himself of necessity an active fomenter of rebellion against his predecessor, he must indeed have been an extraordinary person if he could have controlled the turbulent spirits to whom he owed his elevation. He had taken a false position in the outset; and the inevitable consequence of his preceding tactics must have been to divest him of all active authority over the students, when he attained that eminence to which his ambition goaded him recklessly on. Mr. Page was not successful, either as regards the education or the morals of the students; nor could he ever, had he but reflected one single moment, have expected to be. The man who is exalted on the shoulders of the multitude, must always expect to be cast down when he attempts to control them. "Whoso rises by a mob, shall perish by the mob." This is the universal history of faction.

Had Mr. Page been less anxious to grasp the power of Resident-Director, and calmly waited till the council felt the full force of its own difficulties, he might have made terms alike personally honourable to himself and ultimately beneficial to the institution. Instead of this, he hastily accepted the honour and emoluments of the temporary office, subjected to the impertinent interference of the more active busy-bodies of the council, which extended even to the most trivial matters of detail. Persons who knew little or nothing about the nature of education or the truths of science, continually meddled to thwart every plan proposed or adopted in the college; and Mr. Page, with an entire knowledge of this fact, was weak enough to grasp at the shadow of power, and even undertake the responsibility of administering the affairs of the college, when he was virtually destitute of the slightest effective influence.

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The sum total of Mr. Page's mistakes were, we believe, these—he fomented discord, instead of peacefully, as chaplain, endeavouring to bring *all* to a sense of their respective duties—and he accepted a trust which his constitutional character, his previous relations to the students, and the absurdly-limited powers with which he was invested, would, to a man of any prescience, have foretold a total failure.

The disgusting and disheartening state of things was, we should think, sufficiently distressing to the temporary Director; but it was evidently tending to the utter ruin of the college, whatever might be the number of pupils brought within its walls by the incessant advertising which was at that time kept up. The general inefficiency of Mr. Page's administration, though partly created by the factions of the council, was brought continually forward as matter of accusation against himself; and different members of the faction began to look out for a man of *scientific education* and *tutorial experience* to take the management of the "concern." With the character which the college-council had obtained in the professional world, and especially in the universities, this was a task of considerable difficulty; for what man possessing a spark of self-respect, and a competent share of experience and knowledge, would submit to be browbeaten by the factions of the council, or the equally factious teachers who held their appointments direct from the council, and independently of the "Principal" or "Resident-director?" A fellow of St. John's (whose name we do not give, as he did not ultimately fill the appointment,) of no very high mark as a man of science, was ultimately prevailed upon to accept the office of Principal; but upon careful investigation of the state of the college and especially upon the discovery of the shackles, which must form part of his livery of servitude, he very properly declined the offer. We commend him for it; and congratulate him on his escape from a state of worse than Egyptian bondage.

Finding, however, that this party-spirit, or the college—one or other—must be given up, "the *learned* council," (as our correspondent, "A Civil Engineer and Architect," rather ludicrously calls it,) having more respect to the pelf than even their own patronage, were compelled to yield the point. No man of talent or reputation could be found to accede to the degrading conditions—could be induced by pecuniary considerations—or cajoled by flattering misrepresentation, to take the management of the college: they yielded to the necessities of their position. We award the council no credit for this step, as the little factions in it did not surrender their little interests till the existence of the whole was most seriously jeopardised—in fact, all but annihilated. Had, indeed, Colonels Jackson and Hutchinson, and Mr. Page, acted in the straightforward and decided manner that the present Principal has done, instead of worming themselves into office with the mere possibility of seizing the entire power, the college would never have become a bye-word and reproach — the nuisance of its neighbourhood, and the disgrace of the profession for whose education it was ostensibly instituted. Mr. Cowie demanded, as a first condition, the *absolute control of the entire undertaking, and that no interference should in any shape be made with respect to his arrangements*. The incubus was shaken off, and the college prospers; but the present Principal is "the man of the thousand." Few men but him could have redeemed the college from its load of shame and its load of corruption!

However advantageous in all commercial and manufacturing undertakings the "joint-stock principle" may be, it has been proved, without one single exception, unsuccessful in respect to educational establishments. The Putney College is only one case in point, in proof that in affairs of this kind the old adage is a true one—"too many cooks spoil the broth." Universally, the principle of committee management in the joint-stock schools has been abandoned from the total inadequacy of councils and committees to carry out any effective scholastic system. The general plan adopted has been to "farm out" the school to some one person, reserving to the proprietors certain pecuniary privileges as to the education of their own sons and nominees; and even then, the speculators may deem themselves fortunate if they can secure a third or fourth-rate man to risk the responsibility of redeeming the school from the effects of former mis-

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management. We do not believe that an instance can be adduced of one of these schools, whilst under the management of a committee, retaining the same set of masters for three years, or even for two years together; and yet as these masters are, many of them, university men, (though, indeed, mostly of a low grade of intellect,) we should be led to think that so much deference would be paid to their judgment, and so much power of independent scholastic discipline conferred upon them, as to render these schools eligible situations for the "common degree men," the *polloi* of our universities. But, no—the spirit of impertinent interference is always displayed by the ignorant and illiterate money-grub. Yet, strange to say, in spite of the universal failure of this system in every case where it has been tried, we daily see new institutions formed on the same principle, constituted by the same class of speculators, and officered by the same order of schoolmasters. Even the Government Schools of Design scarcely offer a shade of exception to the ordinary fate of all other schools under committee management; but the centralising principle of modern legislation is involved in these, and they will be kept open in spite of every other consideration, till bare walls and empty benches attest the inadequacy of the system beyond being mistaken, even by the dulness of the statesman-mind.

We have yet to take a survey of the system of education pursued during the different "phases," (we use Colonel Jackson's term,) of the College for Civil Engineers. We consider this a matter of great moment, as it intimately concerns the rising generation of our own profession; and for this reason, too, we consider it a subject that comes fairly within our editorial province.

(To be continued.)

THE PADDLE AND SCREW.

Come, Mr. Editor, I am not so far out after all with *Fairy* and *Garland's* particulars. "Four feet and $\frac{8}{10}$ in length;" this will not enter into the thing much, for I suspect it is all in the dead-wood. The additional length, then, will not interfere with the speed much; and *Fairy* is really $1\frac{1}{3}$ *inch* more beam than *Garland*. This is certainly "hunting small deer." Why, if the *edges of the copper* on the *Garland's* bottom, that are presented to the headway of the ship, were calculated, it would amount to more. The copper on the *Garland's* bottom is about $\frac{1}{8}$ an inch thick, 14 inches in width, length—no matter what. Now, 14·32 is 7·16, and 7·16 is $\frac{3}{15}$ and $\frac{1}{160}$; so we could very soon make up $\frac{3}{4}$ of an inch on each side. But *away* with such trifles! I have not patience with them. I will just say, that the increased depth of *Garland*, 1 foot $\frac{2}{10}$, will more than bring the rest to an equilibrium. I may observe here by the way, that Captain Halsted is easing up a bit; for I perceive he says that the tonnage of the *Fairy* is 312, whereas, in all his other communications, I think he says 320. I do not wish it for one moment to be considered that I quibble about a few tons, one way or the other; I only desire it to be observed that others may not be quite right to a few tons, as well as myself. The point I intend to go into more fully is the *steam pressure in the boiler*. Captain H. states that the *Fairy* is working at 10 lbs. (?), *Garland* 16 lbs. Now, Mr. Editor, what I want to put before the readers of your journal is, that although the steam pressure in the boiler is much more, it is not so in the cylinder. What I intend to convey distinctly is this, that the mean of the pressure in the cylinder of the *Garland* is not as much more as the increased steam pressure in the boiler would lead one to suppose; for it is at the expense of a bad vacuum. Does Captain Halsted know anything about indicator diagrams? I think he does. And has he seen the *Garland's?* I have had an opportunity of examining them, and I beg to say that the atmospheric line is much nearer the vacuum than the steam, showing a bad condensation. But let me ask Captain H. what he supposes the effective pressure in the cylinder of the *Garland* was when she had her throttle valve eased to keep her station with the *Fairy*, that is, when she spared her the six or seven revolutions? Captain H., no doubt, knows; and that difference will allow for the little increase in the diameter of the cylinder. About three horses power nominal in each cylinder, will be pretty nearly the amount due to the increased diameter of *Garland's* cylinder over the *Fairy's;* and as the horses power must be increased as the cubes of the velocity, we must look

for the superiority elsewhere,—not in the dead-wood, but in the vessel's side, in the shape of a good paddle-wheel—an instrument well tried, and not disposed to serve us the *slip*pery tricks the screw has done. In speaking of the *Garland's* paddle-wheel, there is one thing I can scarcely allow to pass. In calculating the speed of the pistons of the two vessels at the *maximum* number of revolutions, as given by Captain H., I find "*one stroke of the piston*" in my favour; and the *Garland* having, as she has, a very broad paddle-board, the half revolution would tell upon the ship. So far I love this. I merely mention it to let Captain H. see that I am up to his calculating the speeds of the pistons at the *minimum* number of revolutions as given by him; for no doubt when the *Fairy* was trying with the *Garland*, they screwed all they could out of her. A little jockeying here I think. Captain H. is evidently more careful with his numbers in some of his later letters than in the earlier ones, for he has brought down the *Fairy's* speed, with her one boiler, to something less than we had at first.

May I ask, Sir, what are we to consider fair tests of the screw? The *Phœnix* it seems is not one. Neither is the *Rattler*, because her engines are of the paddle kind; but here let me tell Captain Halsted, that the engines in the *Rattler* were made for the screw. Messrs. Maudslay and Field are not in the habit of putting in such short-stroke engines as in the *Rattler*. No, no, Mr. Editor, this will not do. Then, the *Fairy* is not a fair test, and the *Teazer* is not; and so I suppose, with all the rest of them; none of them come up to the paddle, and *therefore* they are not fair tests! By-the-by, the *Dwarf* might be named also. Is she a fair test? Will any one tell me that with 90 horses power, and strong steam, fitted with paddles, she would not have done more than she did with the screw; aye, and something worth talking of. The *Minx*, too, would she not, with her 100 horses power and strong steam, in a complete shell, have done more? The Admiralty have done quite right in stopping the building of the screw boats in progress, until the thing is fairly and surely tested. Nothing shows the thing so clearly as the fact of the merchant steam-marine not adopting the screw as a primary power; they only use it as an auxiliary. If it were equal to the paddle in every way, we may be quite sure they would adopt it; they like to get all they can out of a ton of coals. By-the-by, this leads me back to the *Garland* again. I should have stated that the object in her is speed, without any reference to fuel consumed, seeing that she has a coal depôt on each side of the channel to fall back upon; neither as yet have they used the steam of much pressure; they have used it in quantity only, by working up the engines to a speed much beyond that for which they were intended. I wish, Mr. Editor, they would put the *Rattler* in the mail service for a time. Let her run with some of the Malta packets—steam from point to point—and let the coals she consumes be looked well after. We should then see what she is capable of doing. It is not by box-hauling about with a fleet, and having a few hours steaming in the week, that we can judge of her capabilities. Let her do some work, and let her contend against the weather; and last, not least, against time with her steam power. Never mind her sailing—we want steamers for other work besides jogging after fleets. But more of this when I speak of the advantages the screw has over the paddle *in some points*. There has been such a chain of lucky circumstances attending the *Rattler*, that every one almost has been led into the supposition of her being the best steamer. She only had one or two trials under steam with any thing like bad weather; that was on her cruise to Milford with the *Royal Yacht* and *Black Eagle*, and with the *Alecto* in the North Sea, and her performances in the former trial are well known. The two vessels arrived at Pater about twelve hours before her, in the short run from Falmouth to Milford. When the *Yacht* was going ten knots, the *Rattler* was going two. How is it, Mr. Editor, that there should be such a difference? Why they tried to push the *Rattler's* head to wind, when she gets quite obstreperous, flounders about with a spout at her tail, like a thing gone mad. She had no sail to assist, or rather the screw had no sail to assist it in doing its work. As "Truth" says very justly, "it glories on having a wind where sail may be employed to perform part of the duty." I am fearful, Mr. Editor, I am

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encroaching too much upon your time; as well as on the space of your highly esteemed and scientific Journal. I fully appreciate the favour rendered by the insertion of my letters, and trust your readers have patience enough to read them. They have been written, not with a view to simply differ with Captain H., but to bring out for the benefit of the nation all that concerns the comparative merits of the screw and paddle. I feel myself fairly entered in the ring, and with *no common* opponent. I must use my science to meet him; he gives me some hard hits; but never mind—I have a favourite hit or two to come out with, and it shall not be my fault if they are not hard ones. The *Screws*, I am sure ought to be proud of having such a champion, for every one must acknowledge, that he does in every way do them

JUSTICE.

London, December 21, 1847.

COMMUNICATION BETWEEN FIRE-ENGINE STATIONS.

Sir,—The subject of electricity is at the present time beginning to receive a great share of public attention; and the galvanic battery, which a few years ago was wholly confined to the chemist's laboratory or the public lecture table, has now become an instrument of common use, and employed not merely to illustrate scientific theories, but rendered practically available for many useful purposes in the arts. Perhaps one of the most astonishing and useful applications of this subtle agent has been the instantaneous communication of signals by the railway telegraph; and as it is proposed not to confine this voltaic communication within the limits of certain railway termini, but to extend it to various offices in and about London, I beg to suggest its application to the various fire-office stations in the metropolis. For whatever progressive improvements may have been made in the machinery for extinguishing fires, if the locality is not known, and timely aid is not afforded, it is too frequently followed with a melancholy loss of life.

Now, if the engine-stations in and about London were supplied with this telegraph communication, the moment it was known at one, the signal might be given to all the others instantly: and when we consider the immense amount of property so frequently destroyed, which generally falls upon the insurance-offices, I should think it would be worth their consideration to endeavour to adopt some more efficient means to arrest its progress.

Perhaps your correspondent, Mr. Baddely, who has great practical acquaintance with these matters, may bring the thing more prominently before the public.

I am, Sir, &c.,

HUNTER IRVIN.

8, Great George-street,
Euston-square.

THE ATMOSPHERIC RAILWAY SYSTEM.

Sir,—Having read in the *Mech. Mag.* (No. 1219 and 1220) an account of the important discussion on the atmospheric system of railway conveyance, which took place at the Society of Civil Engineers—and having previously read Mr. Robert Stephenson's Report on the imperfections of the Dalkey atmospheric line, and the atmospheric system generally,—I have in an humble way arrived at certain conclusions which I shall be glad to place before the public through the medium of your pages. I believe the system to possess advantages, which that eminent engineer, and the society of which he is so distinguished a member, show no present signs of believing.

We are informed at the commencement of Mr. Stephenson's Report, (p. 2,) that the *maximum* velocity an atmospheric railway can attain, is determined by multiplying the area of the air-pump piston into its velocity, and dividing that sum by the area of the piston in the vacuum tube. "For example, at Kingstown, the diameter of the air-pump is 67 in., and that of the tube piston 15 in.; the velocity of the former is 253 feet per minute, or nearly 3 miles an hour; and hence the velocity attainable by the latter will be about 60 miles an hour."

Were this rule applied under a similar case to water, or any other non-elastic fluid, I would perfectly subscribe to its correctness, but to an aëriform body the principle does not to me appear equally applicable. I wish it, however, to be understood, that I make these observations, and the following remarks, with great deference to the great experience and high talent of Mr. Stephenson, and the more especially as his opinion on this

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point has passed unquestioned by the Society of Civil Engineers. In the discussion alluded to (No. 1220, p. 618), Mr. Stephenson says, "In the recent parliamentary inquiry, Dr. Robinson had given an opinion which demanded special notice." "It was not a sound practical illustration of a true theory, inasmuch as it involved some circumstances which were not possible, and excluded others which had a positive existence, and, however perfect the argument might be as a piece of abstract reasoning, it was irrelevant to the practical discussion of the subject."

Dr. Robinson appears to have sinned against the locomotive engine (the favoured machine of the day) by supposing an atmospheric tube to be perfectly exhausted prior to the train starting; and then deducing, that a steady mercurial gauge might exist without giving any indication of velocity in the train; whereas Mr. Stephenson says, a steady mercurial gauge is a true indicator of a train having acquired its highest mean velocity, and accordingly, from this sign, he has made his calculations on the capabilities of the atmospheric system. It shall be my endeavour to prove, that a steady mercurial gauge, and uniform velocity in a train, are both at variance with the principle of an atmospheric railway.

In the first place, if a train starts at the further end of the line from the engine, and has sufficient power to subdue the whole length of the leakage of the tube, and give motion to the train, the motive power of the engine will virtually increase as the train approaches it, from the length of leakage diminishing, conjointly with the cubical contents of the tube. The rarefied condition of the air in the tube will be much affected by these causes; and as they are inherent principles in the atmospheric system, a steady mercurial gauge, with the engines at work and the train in motion, is impossible. It is also clear, that if the air in the tube is rarefied with greater rapidity as the train approaches the engine, the last moment before the breaks are applied, or the train leaves the tube, if the engine be still at work, is the time the highest velocity is attained on an atmospheric line.

It has been supposed that the traction of the train and resistance of the atmosphere, balance the motive power when the train has acquired its *maximum* mean velocity, then the mercury is steady, and the train goes on at a uniform speed. Such would certainly be the case, were the tube perfectly exhausted; but while air remains, and the capability of the engine rapidly increases to reduce the tube to that condition, there is no more chance of a stationary mercurial gauge, *on sound principle*, or of the train having a uniform velocity, than there is of uniform speed in a locomotive engine, if invested with additional power at every revolution the wheels make, as the ponderous machine moves along the line.

I shall take another view of this subject, and suppose two tubes of different lengths and diameters; one of them 1 mile long and 30 inches diameter, and the other 4 miles long and 15 inches diameter. Let them be joined endwise, air-tight, and a piston fitted to each, the small tube to have the piston at the single end, and the large tube the piston where the ends join. If the intermediate space between the two pistons is filled with water, and the large piston receives motion equal to 10 miles an hour, the small piston would travel at the rate of 40 miles an hour, from the area of the large tube being four times the area of the small one. In this case the pistons would both start and arrive at the same moment. Again, suppose the small piston to be retained until the larger one is half on its way—then, if both pistons arrive at the same time, as in the former instance, the small piston must have greatly exceeded the rate of 40 miles an hour to do so; and if it arrives any time after, decidedly less than three minutes, or the time the large piston started before it, it overruns Mr. Stephenson's calculated velocity, and his formula falls to the ground. On the other hand, if a uniform velocity of 40 miles an hour is maintained by the small piston, after the large piston has attained a state of rest, on what ground, let me ask, does the prescribed velocity depend?

Such, in reality, is the principle of working an atmospheric railway. A large portion of the motive power is stored up in the vacuum tube, to be put forth when wanted; and this quantity of power is the start the engine has of the train, and can never be exhausted during the *race of the pistons*, unless the small one in the vacuum tube, as before observed, exceed the calculated velocity.

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If I am right in my theory, the algebraist will find a new formula for the velocity in question; if wrong, I regret it on account of the system, believing it the most safe, economical, and expeditious mode the ingenuity of man has yet devised for the universal application of steam power to inland public conveyance and commercial traffic.

I am, Sir, yours, &c.

JAMES WHITE, C.E.

Walcot Place, Kennington Road, January 12, 1847.

ON THE NECESSITY OF CONSIDERING THE EFFECTS OF "TIME," AS AN ELEMENT IN SEVERAL DYNAMICAL PROBLEMS, WHERE IT IS GENERALLY OMITTED; WITH REFERENCE TO AN IMPORTANT ERROR IN ENGINEERING.—CONTINUED FROM VOL. XLV., P. 617.

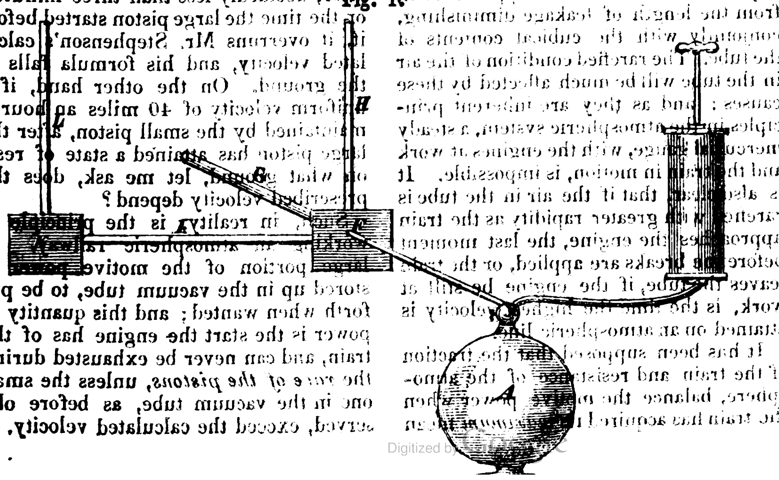
The connection between the pressure and motion of elastic fluids has been experimentally illustrated by several authors. The celebrated Hawksbee was one of the first experimenters on this subject. The following account is taken from Sir John Leslie's article on "Meteorology," in the *Enc. Brit.*: "Having connected the square box cisterns of two barometers by a horizontal brass pipe of 3 feet in length, he inserted in the side of one of the boxes another pipe opening upwards, and connected the opposite side with a pipe attached to the neck of a large globular receiver, into which three or four charges of atmosphere had been compressed. On turning the stop-cock, the imprisoned air rushed with vehemence over the surface of the mercury in the cistern, and effected its escape, while both columns fell simultaneously about 2 inches, and gradually rose again as the force of the blast diminished. From this experiment Mr. Hawksbee formally derives four distinct corollaries:

1. "That we have hence a clear and natural account of the descent and vibrating of the mercury in violent storms and hurricanes." 2. "That not only the different forces, but also the different directions of the winds, are capable of producing a difference of the subsidence of the mercury." 3. "That strong winds may affect the animal economy upon this very account, of their altering the pressure of the atmosphere;" and, 4. "That the weight of the atmosphere being diminished in one place, it is also as much diminished at the same time in another place which holds a communication with the former."

On this experiment, which Sir John Leslie regards as an "illusion," he makes the remarks following:—"The peculiar result proceeded from a mere casual circumstance, the exit pipe from the mercurial cistern being wider than the pipe which introduced the current of air. This incidental arrangement is not mentioned in the description of the apparatus, and we have therefore caused the original figure to be engraved on a reduced scale, not only to prove the fact which we have just stated, but also to warn experimenters of the necessity of noting scrupulously every accessory circumstance blended in their operations."

I give a rough sketch of the figure.

Fig. 1.



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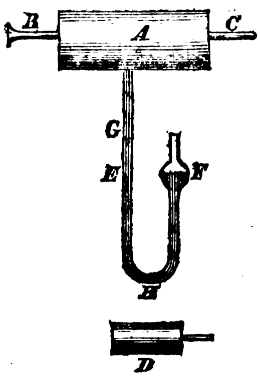
"It is easy to perceive, that the tube G, which discharges the air from the box F, is much wider than the tube E, which conveyed it from the receiver A. This air, previously condensed and still restrained in its passage through E, on entering the cavity of the box, immediately expands beyond the limit of equilibrium, and, finding an easy escape through G, allows that state of dilatation over the mercury during the time of the horizontal flow. But the air contained in the other cistern, K, must, from its communication by the slender pipe I, suffer a like expansion, and consequently the columns L and H will, in the same time, subside equally."

Now, in the first place, it is rather a cool trick of Sir J. Leslie to turn round on Hawksbee, and say, "Your experiment itself is absolutely fallacious."—"Why?"—"Because, though not stated in your own description, I yet discover from a microscopic examination of your figure, that the tube G is larger than the tube E."

However, he goes on to prove the fallaciousness of the thing by the following experiment of his own:

Fig. 2.



"Let A be a cylinder of tin, suppose 3 inches long and 2 inches in diameter, having an open pipe inserted at B, a quarter of an inch wide, and perhaps 2 inches long, and another opposite pipe inserted at C, about $\frac{3}{8}$ or $\frac{1}{2}$ inch wide and 1 inch long. At right angles to these a recurved glass tube, or siphon, G H E, of $\frac{1}{10}$ inch bore, is cemented below, descending 12 inches, and rising again 6 inches to the open swell at E, which contains coloured water terminated at F. Holding the cylinder in a horizontal position, and applying the mouth at B, let a sudden blast be injected into the cavity, the water will rise instantly to G, thus showing the diminished pressure, and consequently the rarefaction of the air above it. But if a cap D, with a narrow projection, of perhaps only the eighth of an inch, be adapted to the exit-pipe C, on repeating the experiment an opposite effect will take place, and the column of water, so far from mounting to G, will now sink to H. It is evidently the difficulty of the escape through D that occasions the accumulation of the air within the cylinder, and the consequent depression of the water in the siphon. These different results are perfectly analogous to the local fall or rise of the surface of a river, occasioned by the widening or contracting of its channel."

Now, of course, it is plain enough, that the pressure of the air in the cylinder and siphon will depend on the quantity of air introduced, as compared with the quantity which escapes in a given time. When the tube D is fitted into the cylinder instead of C, the narrowness of the orifice preventing egress in one direction, the compressed air forces its way in another, viz., down the siphon. But this does not explain how it is, that when the tube C (or any larger one) is used, the vertical pressure of the air in the cylinder is *diminished*. In this case, one of two things must occur—either more air escapes through C than is introduced through B; or else, if the quantity of air remains the same, its vertical pressure is diminished by its horizontal motion.

It is very difficult to decide between these two suppositions. The first seems to be that contemplated by Sir J. Leslie; for in another part he says, "It is conceived that a current of air, in sweeping over the surface of the earth, must cease to exert any vertical pressure. But this assumption can hardly be reconciled with any strict principle in science, for the particles of air will not for a moment cease to gravitate, *nor will any horizontal motion of them produce the slightest derangement in a perpendicular direction.*" Now, this is the very point to which I desire to call attention. The present experiment is only one out of an immense multitude of facts—of which no satisfac-

tory explanation has been hitherto given, and which, I suspect, require the consideration of "Time" as an element in the calculation, and that, too, in a manner very different from the way in which it is generally introduced. In fact, the question arises, are not all (so called) *statical* problems, in reality, *dynamical* ones? For instance, in the present example, though there can be no question that "the particles of air will not for a moment cease to gravitate," is it quite certain that the *effect* of such "gravitation," measured as a *pressure*, does not depend on the time during which it is exerted? To make my meaning plainer: Suppose a particle of matter (air, or any other kind of matter,) to rest on a plane surface. The effect of gravitation measured as a pressure, is the *weight* of that particle. Now, whenever we in common usage, or even in delicate scientific experiments, have to estimate this pressure or weight, we are absolutely necessitated to do so during a *certain time*, viz., while we hold the balance, &c., and this duration of time is always (comparatively speaking) a very large one, when compared to the time during which the great majority of impulsive forces act. If, then, our particle is in motion, so that the time during which it is in contact with any particular point of the surface is less than the smallest time in which its *weight* can be taken, are we sure that its *pressure on that spot* may not be *less than its weight?*

As the subject is thus naturally brought before me, I may be permitted to state that the whole mass of phenomena with which the progress of science has made us acquainted, appears to lead to one conclusion—and that is, that no particle of matter is at rest; almost every fresh discovery being, in one form or other, a discovery of motion where none was previously thought of. Under the present mode of viewing, or at any rate of treating the subject, we have no connection between "pressure" and "impact." If, however, the views here alluded to be correct, we have no longer this breach of continuity (for such it is) between the two classes of effects: the difference being one of time. It is very certain, that all our notions of "pressure" are derived from *motion*. We have no conception of the "pressure" of a "quiescent" mass, until we have lifted it and measured it by our muscular *exertion*, viz., motion. For the balance merely gives us a *comparison* between two pressures, and tells nothing about *one* pressure.

As illustrations of this mode of regarding the question, I may refer to instances where a structure, or support of any kind gives way, "all at once," to an incumbent pressure, which it has borne a long time. If there were no motion in such cases previous to the final crash, I am utterly at loss to comprehend them, (I leave out of the question all such influences as decay, &c.): but if we look upon the pressure as a succession of indefinitely small impulses—the accumulation of these into a finite and perceptible motion is easily understood. The transit of a locomotive over a bridge, unable to bear its weight if stationary, may be considered an illustration, inasmuch as the duration of the contact determines the result.

To return to the experiment of Sir J. Leslie. I am by no means prepared to say that the second supposition made in regard to the action is the correct one. It may be true, that more air escapes than is introduced; but I think there are some objections to the supposition, when a steady current of air is kept up; and I can hardly see how the velocity of the escaping particles can be greater than those propelling them, which yet must be the case if more escape than are introduced.

The action is precisely analogous to that of which I gave an example in my last paper, viz., the "sucking out" of a pane of glass by a gust of wind *parallel* to its surface. Those who take an interest in such experiments are referred to a paper by Mr. Ewart, in the *Phil. Mag.* for April, 1829; some of whose experiments are almost exactly the same as that of Sir J. Leslie. As that work may not be accessible, however, to many, I extract the substance of two.

Fig. 3.

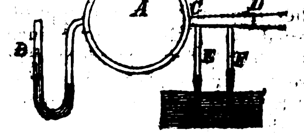


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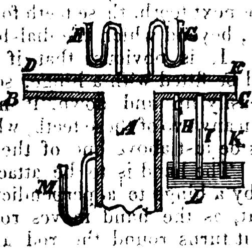
Fig. 4.



In fig. 1, A is a transverse section of a cylindrical pipe, which conducts air from a blowing apparatus to a furnace; CD, a conical tube whose internal diameter at C = ·4 of an inch, and 1·05 inches at D, which end was open to the atmosphere. E and F dip into a trough of mercury, and B is a siphon containing mercury. The pipe E was half an inch from the centre of A, and F was 2·2 inches from that centre. The blowing apparatus being set to work, (the air passing through A with a velocity of 45 feet per second,) the mercury stood 1·8 inch higher in the outer than in the inner leg of the siphon; while the mercury in the trough rose 2·7 in the tube E, and only ·4 of an inch in F. On the internal pressure in A being increased, the mercury rose higher in nearly the same proportion in E and F.

Fig. 2 hardly needs any explanation. A is a pipe 4 inches internal diameter, communicating with a reservoir of compressed air; BC and DE, sections of flat circular pieces of wood, placed at any required distance from one another by means of screws. The tubes, siphon, trough, of coloured water as before. The distances of H, I, K, from interior of A, were ·9 in., 2·1 in., and 3·4 in., respectively. When the compressing apparatus was set to work, the siphons G and M indicated each an interior pressure of 1·25 in., and the siphon F 1·3 in. of mercury. The coloured water rose ·9 in. in H, 2 in. in I, and half-an-inch in K. On the interior pressure in A being increased, the coloured water rose higher in nearly the same proportion in H, I, and K; and the amount of the downward pressure on DE still much exceeded that of the upward pressure from A.

APPARATUS FOR COMMUNICATING BETWEEN THE PADDLE-BOXES AND ENGINE-ROOMS OF STEAMERS.

Fig. 1.

Fig. 2.

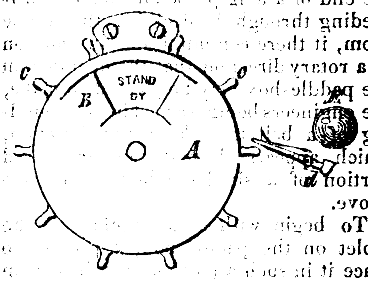
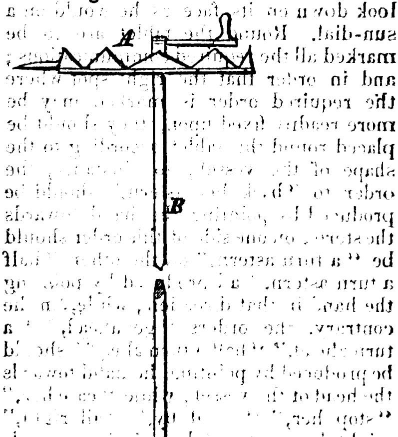


Fig. 3.



Sir,—May I be allowed to trespass on your valuable time for a short period, in order to bring under your notice an invention of mine,—for forming communications between the Captain on the paddle-box of a steamer with the engineers in the engine-room.

An electric telegraph has been adopted in some navy steamers, but is much too expensive for general use, and is, besides, unnecessarily complicated for the purpose; indeed, I am not aware that it has ever been applied to the paddle-boxes, (where the communication is always most required,) the apparatus being fitted only for the quarter-deck.

My invention consists in a face or tablet attached to the railings of the paddle-boxes, having, marked round a circle, the necessary directions to the engineers; this is furnished with a sort of index-hand, which, being attached to the end of a long perpendicular rod proceeding through the deck into the engine room, it there communicates any motion in a rotary direction that the operator on the paddle-box may be pleased to make, the engineers being warned by the sounding of a bell to look on the direction, which appears through an uncovered portion of a similar tablet to the one above.

To begin with a description of the tablet on the paddle-box, I propose to place it in such a position that the person who works it (by turning the hand) can look down on its face as he would on a sun-dial. Round the tablet are to be marked all the required communications; and in order that the right spot where the required order is marked may be more readily fixed upon, they should be placed round the tablet according to the shape of the vessel; for instance, the order to "back her astern," should be produced by pointing the hand towards the stern: on one side of this order should be "a turn astern," on the other "half a turn astern," all produced by pointing the hand in that direction; while, on the contrary, the orders "go ahead," "a turn ahead," "half a turn ahead," should be produced by pointing the hand towards the head of the vessel; while "ease her," "stop her," "stand by," "all right," might be produced by pointing towards each side of the vessel. The tablet hand should be made to lay in hollows or rests at each direction, so that, supposing there were ten directions, there should be ten rests also, so contrived that the hand will not remain between any two directions marked on the tablet, but only exactly above the direction required, which I should accomplish in the following manner:—The circumference of the tablet should be surrounded with ten upright teeth, the sides of each of which should slant downwards till they join a similar slope in the next tooth, these teeth forming a circle, beyond which the dial-hand protrudes. It is obvious, that if the tablet-hand be fitted with a hinge, so as to move easily up and down, it must rest between any two of these teeth, which will always be just above one of the ten directions. The hand is to be attached at its root by a hinge to a perpendicular rod, so that, as the hand moves round the tablet, it turns round the rod also; but no motion of the rod follows the movement of the hand up and down on its hinge. Fig. 1 represents the tablet, with the directions marked at *a a*; the hand is seen at *b*, resting between two of the teeth at *c c*, and just over a direction at *a*. The hinge and a section of the perpendicular rod is seen at *d*, which rod proceeds into the engine-room, and terminates in a tablet with similar directions, which tablet revolves with the rod, it being fixed to its centre; but in order that the engineers may know the directions issued, the tablet is provided with a cover, which conceals all the directions but one; but, as the tablet revolves, a different direction will appear alternately; this cover, of course, remains stationary. The revolving tablet is fitted with similar teeth to the one above, but instead of being upright, they all point in a horizontal direction round the edge of the tablet. These teeth move a hammer furnished with springs, and, as they pass in succession, they cause it to strike a bell alternately, so that not a single order can be issued without the bell being struck. The engineers are thereby warned to look at the tablet, and there see only the order they have to obey.

Fig. 2 represents the lower tablet with its fixed cover, A; the order to the engineer is seen at B, the bell having been just struck by one of the teeth, *cc*, lifting the hammer, *d*, and sounding the bell at E.

Fig 3, is a rough sketch of the whole apparatus in its proper position. The upright teeth, hand, and directions, are on the tablet at A, as described at fig. 1. The perpendicular rod is seen at B, and connects it with the tablet under the cover at C, where the horizontal teeth, directions, hammer, and bell, are seen as described in fig. 2.

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The index hand is provided with a handle, as shown at A, in fig. 3.

By this simple apparatus the engineers will be warned by the bell of every fresh direction, and, on looking at the tablet, will see only the order they have to obey, and so can carry out their orders with more certainty and precision than by the usual means of trusting to a second party — the chances of error usually being twofold, for the boy may mistake the captain, and the engineers may mistake the boy; many instances of which I have seen occur, and which very often, no doubt, may lead to serious accidents.

I am, Sir, yours, &c.,
JOHN N. FENNINGS.

2, Park-place, Stoke Newington,
Nov., 1846.

FALL OF A SUSPENSION BRIDGE IN THE EAST INDIES, ATTENDED WITH GREAT LOSS OF LIFE.

Bath, Jan. 8, 1847.

Sir,—The following paragraphs, copied from the Calcutta papers, appeared in the last number of the *Civil Engineer and Architect's Journal*. Will you oblige me by inserting them in your next Magazine, together with a few remarks on the subject?

I am, Sir, yours, &c.,
JAMES DREDGE.

"It is with deep regret we announce a melancholy and most fatal accident which has happened at Jinguruchy, nine miles this side of Jessore. The bridge there recently completed by Captain Duncan, of the Engineers, has fallen. The chains gave way when the bridge was crowded with people, and at the moment three boats were passing under it, which were sunk with all their crews. Our informant says, the loss of life had not been ascertained when a messenger was sent off to Captain Duncan with the report of the disaster, but he computes it at one hundred. We earnestly hope this may prove over the mark. We believe it was only the other day the bridge was examined by Major Sage, and two other engineers, and reported favourably on."

The following paragraph appears in the second edition of the same paper:—

"We have since learnt from Captain Goodwyn, of the Engineers, that this bridge was constructed in England by Mr. Dredge, the patentee, and that Captain Goodwyn reported unfavourably of it on its arrival here; and also the committee, that examined it after its erection, decided that the structure was only fit to endure the weight which would be placed upon it by ordinary traffic. On the occasion of the sad accident in question, some five or six hundred persons were on the bridge for the purpose of witnessing a poojah, and the accident was mainly owing to a sudden rush of the whole crowd to one side of the bridge, which our readers may remember was the case in the Yarmouth catastrophe, which happened about twelve months ago. There is no doubt that on such an occasion there should have been police stationed to prevent the structure from being overloaded."

It is quite true that the iron-work of this bridge was manufactured by me, but the plans were made by the Indian government, and sent to me, with the dimensions of every part specified, and strict injunctions given that they should be adhered to. These directions were observed in every particular, with the exception of the iron beams of the roadway, which was the part (and not the chain) that gave way; and these were made 25 per cent. stronger than is depicted on the drawings.

Even with this increase of material, I was perfectly aware that the beams were insufficient of themselves to resist the whole of the horizontal strain; and I called the attention of the engineer to this particularly, and told him that, in the erection of the bridge, he must construct the platform so that the timber planking might be made to assist the beams in resisting the horizontal strain—that is, in the platform; for, that the *beams were quite insufficient for this purpose*, and begged that an engineer might go out from England to assist in the erection. These instructions were not attended to, — at least, I presume not; for I heard nothing of the bridge from the time it left England (now upwards of three years ago) until the other day that the post brought intelligence of its failure.

I am, Sir, yours, &c.,
JAMES DREDGE.

BRIDGE-BUILDING.

[From Sir John Rennie's Address to the Institution of Civil Engineers.]

Westminster Bridge, by Labelye in 1740-47, may be considered the first example of extensive structures of this kind. It consists of 13 semicircular arches (the centre of which is 75 feet span), 1164 feet long;

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it was originally intended for a wooden bridge, and was partly commenced on this principle; it was a great work at the time, but, as might have been expected, contained defects, particularly in the foundations, which at that time were but imperfectly understood, and have suffered much by the scour of the current; it will probably be rebuilt in a short time. Caissons, or water-tight chests, were first introduced there for the purpose of founding the piers below the level of low-water. Previous to this, the principal existing bridges consisted of a number of small Gothic or of circular arches, with rough piers of masonry built either upon a foundation of loose rubble stones thrown promiscuously into the river until sufficiently high and solid, or upon timber platforms resting upon piles surrounded by large bulwarks of timber, filled with loose stones, called starlings, which materially contracted the water-way where they were placed, and by causing increased rapidity in the current, created great obstacles to the navigation, as well as to the drainage of the adjacent country. Of this, the well-known examples of Old London Bridge, those at Newcastle-upon-Tyne, Rochester, and Belfast, may be mentioned. All these, with the exception of Rochester Bridge, are now removed, and are replaced with others constructed upon the modern improved principles. Westminster Bridge was followed by that of Blackfriars, by Mylne (1760-71), consisting of 9 semi-elliptical arches, the largest of which is 100 feet span, and 41 feet 6 inches rise; the total length of the bridge is 995 feet, and 45 feet wide; here the elliptical arch was introduced about the first time in this country. Smeaton's bridges of Coldstream across the Tweed, in 1763, composed of 5 circular arches, the largest of which is 61 feet span; that over the Tay at Perth, in 1766, of 9 circular arches, the largest of which is 75 feet span; at Hexham, over the Tyne, in 1767, of 9 circular arches, the largest of which is 52 feet span, and others, for that period, were works of considerable magnitude. These were followed by numerous smaller works all over the kingdom, more remarkable for convenience and utility than for any peculiarity in their construction worthy of notice, until in 1809-17, when Waterloo Bridge, across the Thames, consisting of 9 equal semi-elliptical arches, 120 feet span each, and 35 feet rise, was built of granite, in a style of solidity and magnificence hitherto unknown. There the elliptical arch, with inverted arches between them to counteract the lateral pressure, was carried to a greater extent than in former bridges, and isolated coffer-dams upon a great scale in a tidal river, with steam-engines for pumping out the water, were, it is believed for the first time, employed in this country; the level line of roadway, which adds so much to the beauty as well as the convenience of the structure, was there adopted. The bridge across the Severn at Gloucester, in 1828, by Telford, is worthy of remark, as being the first with one arch, of 150 feet span, like those of the bridge across the Seine at Neuilly, near Paris, by Perronet, where the interior of the arch is elliptical, and the exterior circular.

New London Bridge (1825-31), consisting of 5 semi-elliptical arches, viz., two of 130 feet, two of 140 feet, and the centre 152 feet 6 inches span, and 37 feet 6 inches rise, is perhaps the largest elliptical arch ever attempted; the roadway is 52 feet wide. This bridge deserves remark, on account of the difficult situation in which it was built, being immediately above the old bridge, in a depth of from 25 feet to 30 feet at low water, on a soft alluvial bottom, covered with large loose stones, scoured away by the force of the current from the foundation of the old bridge, the whole of which had to be removed by dredging, before the coffer-dams for the piers and abutments could be commenced, otherwise it would have been extremely difficult, if not impracticable, to have made them water-tight; the difficulty was further increased by the old bridge being left standing, to accommodate the traffic, whilst the new bridge was building, and the restricted water-way of the old bridge occasioned such an increased velocity of the current as materially to retard the operations of the new bridge, and at times the tide threatened to carry away all before it. The great magnitude and extreme flatness of the arches demanded unusual care in the selection of the materials, which were of the finest blue and white granite from Scotland and Devonshire; great accuracy in the workmanship was also indispensable. The piers and abutments stand upon platforms of timber resting upon piles about 20 feet long. The masonry is from 8 feet to 10 feet below the bed of the river.

I will conclude this division of the subject with the celebrated bridge across the Dee at Chester. It consists of a single arch, the segment of a circle 200 feet span, with a versed sine or rise of 42 feet, which is the largest stone arch upon record; the arch stones at the crown are 4 feet 6 inches deep, and 7 feet at the springing, and the abutments on both sides of the river are founded on the new red sand-stone. The centre for building the arch was remarkable for its simplicity, strength, and rigidity, by which means the greatest effect was produced by the smallest quantity of timber,

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and any change of form, so prejudicial in centres, was prevented. This fine structure is due (it is believed) to the combined talents and energies of the late Mr. Harrison, the architect, of Chester, who made the original design; Mr. George Rennie, who equilibrated the arch, and gave the proper dimensions of the voussoirs, and form and dimensions of the abutments, the mode of constructing them, and designed the centre, the original model of which is now in our gallery: and to Mr. Jesse Hartley and Mr. Trubshaw, who worked out the details, and carried the whole into effect.

A proper theory of the equilibrium of the arch, which shall satisfy all the conditions of the question, when applied to practice, may be said to be still wanting, though much valuable information may be derived from the scientific works of Hutton, Attwood, Moseley, Gwilt, and others, on the subject.

Oblique or skew bridges have but recently obtained extensive use. Chapman built some in Ireland many years ago, and wrote an account of his mode of constructing them. On railways they were introduced by Stephenson, and are now generally employed. Buck's excellent treatise on the principles and practice of their construction greatly facilitated their execution.

The introduction of cast iron for the construction of bridges commenced about the year 1779, when that over the Severn, near Coalbrook Dale, by Darby, was the first; it consists of a circular arch 100 feet span, and a versed sine of 45 feet, approaching nearly to a semicircle; the height of the springing is 10 feet above low water, and the total height to the under side of the soffit is 55 feet; the banks of the Severn being high, this form accords well with them. It is formed by five ribs of cast iron, with perpendicular spandril pieces resting upon them to support the roadway. This, for a first attempt, is well adapted to the situation, and has answered the purpose. This was followed by the bridge over the Wear, at Sunderland; the design for this was said originally to have been made by Thomas Paine, the well-known political writer, and was cast at Rotherham, being intended for erection in America; but the materials were subsequently employed in constructing Sunderland Bridge, under the direction of Wilson, in 1796, the idea having been suggested by Rowland Burdon. The curve of the arch is that of a segment of a circle, the length of the chord or span is 200 feet, and the versed sine or rise 30 feet, the total height from low water to the under side of the soffit of the arch is nearly 100 feet. It consists of six ribs, each composed of 105 cast-iron radiating pieces, connected at the top and bottom by the circular pieces which form the curve of the arch; these ribs are united in their transverse direction by tie-pieces; the spandrils are filled in with cast-iron circles, touching each other at their circumferences, and supporting the roadway, which consists of a strong frame of timber, planked over, and covered with a cement of tar and chalk, upon which a layer of marl, limestone, and gravel is placed. The centre deserves notice on account of the difficulty and confined nature of the situation, which rendered it necessary to preserve a constant passage for ships with their standing rigging; this was effected by a perpendicular framing, resting upon piles in the bed of the river, with a sufficient opening on each side for the vessels. Upon the top of this perpendicular framing, the transverse framing or centre for supporting the arch was fixed, and answered its purpose well. Sometime after the removal of the centre, the arch was observed to swerve bodily in a horizontal direction to the eastward, forming a curve having a versed sine of about 12 or 18 inches; if this had continued to increase, it would no doubt have soon occasioned the downfall of the structure; it was, however, very skilfully remedied by the introduction of transverse and diagonal tie bars and braces, assisted by wedges and screws, so that ultimately the whole was brought back and secured in its original form and position, where it has since remained in a substantial state without alteration. The width of the bridge is 30 feet; the abutments are of stone, founded on rock; they are 24 feet thick, and from 42 feet to 37 feet wide. This bridge, for boldness of the design and construction, as well as for its elegance and lightness, must be considered a work of peculiar merit; particularly if the period in which it was constructed be remembered.

About the same time the bridge at Buildwas, across the Severn, by Telford, was erected. It consists of a single arch, segment of a circle, whose chord or span is 130 feet, and versed sine or rise 27 feet, the depth of the iron frame forming the arch being 3 feet 10 inches; it consists of three ribs, 18 feet wide from out to out, connected together in their transverse direction by tie-bars. The spandrils for supporting the roadway consist of vertical pieces, resting upon the segments forming the arch; the abutments are of stone. There is a novelty in the construction of this bridge worthy of remark. The two outer ribs consist of two segments of circles each struck from different centres, the crown of one terminating immediately below the roadway, the other at the top of the parapet, so

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that the platform forming the roadway is both suspended and insistent. The object of this being, it is presumed, to increase the depth of the truss supporting the roadway, and thus to add to the strength of the bridge; but it was unnecessary, and does not appear to have been adopted in any of Telford's subsequent designs, which are numerous. Amongst them may be mentioned that of Bonar, Tewkesbury bridge over the Severn, also that over the Dee, near Corwen, &c. Bristol bridge over the Avon, by Jessop, is a neat simple structure. Boston bridge, by Rennie, over the Witham, of 100 feet span, with a versed sine of 4 feet, is remarkable for its boldness and lightness. The principle of construction resembles that of Sunderland, but is an improvement upon it, in having a better system of transverse and diagonal braces, and the spandrils consisting of vertical instead of circular pieces. All these have, however, been far exceeded by the Southwark bridge over the Thames, by Rennie. This consists of three arches, all segments of the same circle; the centre arch is 240 feet span, with a versed sine or rise of 24 feet, and the two side arches are 210 feet span each, with a versed sine or rise of 18 feet 10 inches each. The arches are formed by eight solid ribs in each, and each rib consisting of fifteen pieces, 6 feet deep at the crown of the arch, increasing to 8 feet deep at the springing, 2½ inches thick in the middle, and 4¼ at the top and bottom; these ribs are connected together in their transverse direction by cast-iron tie braces of the same depth as the ribs, but open in the centre, and in the diagonal direction by another series of ribs; the whole of the segmental pieces forming the arch, as well as the transverse and diagonal tie braces, are kept in their places by dovetailed sockets and long cast-iron wedges, so that bolts for holding the several pieces together are unnecessary, although they were used during the construction of the bridge to keep the pieces in their places until the wedges had been driven. Thus the ribs formed, as it were, a series of hollow masses or youssoirs similar to those of stone, a principle which it is believed is new in the construction of cast-iron bridges, but it has succeeded so well that it is worthy of adoption elsewhere. The spandrils are composed of cast-iron diagonal pieces, connected together in a similar manner, and the roadway is formed by solid plates of cast-iron resting upon the spandrils, and joined together by iron cement. The piers and abutments are of stone, founded upon timber platforms, resting upon bearing piles, and surrounded by sheathing piles, driven sufficiently deep below the bed of the river. The masonry is tied throughout by vertical and horizontal bond stones, so that the whole acts as one mass in the best position to resist the horizontal thrust. The ribs forming the arches were commenced in the centre, and were continued regularly on each side towards the piers and abutments, upon which a cast-iron bed and connecting-plate were laid, nicely let into the masonry to receive the ribs forming the arches; when the last segment of each rib was fixed in its place, three cast-iron wedges, each 9 feet long and 9 inches wide, were placed behind each rib, and nicely adjusted and fitted to them; these having a very slight taper, were driven simultaneously by heavy hammers, and thus the arches were nearly lifted from the centres, so that the wooden wedges upon which the segment pieces rested were easily removed by a few blows of a hammer; the arches were thus relieved from the centres in a very simple and efficient manner. The whole of the iron-work had been so well put together by Messrs. Walker, of Rotherham, the founders, and the masonry by the contractors, Messrs. Jolliffe and Banks, that when the work was finished scarcely any sinking was discernible in the arches. During the progress of the work, some experiments were made, in order to ascertain the extent of the expansion and contraction between the extreme range of winter and summer temperature, and upon taking the average of numerous trials by different gauges, it was found that the crown of the arch rose in the summer about an inch to an inch and a half. The work was commenced in 1813, and the bridge was opened in 1819.

Whilst upon the subject of cast-iron bridges, we must not omit the Swivel or Turning Bridge. The invention, if it may be so termed, is, it is believed, due to England, and one was first made of iron about the year 1810. They are now almost universally adopted over locks, to the extent of 50 feet span, in preference to the old lifting bridge. Since the introduction of the railway system, cast-iron bridges have become very general, and have been particularly serviceable, being formed of girders, where the height was too limited to admit of the arch principle being adopted. Experience of the value of wrought iron in roofs and for other building purposes has induced R. Stephenson to propose that material for constructing the bridge to carry the Chester and Holyhead Railway across the Menai Staits. His design consists of a close wrought-iron tunnel or tube, 14 feet

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wide, 30 feet deep, and 1500 feet long, supported in the middle by a stone pier built upon a rock in the middle of the Straits, with two other piers at the low-water mark on either side, leaving four openings, two of them 460 feet, and two of 230 feet each, and 100 feet above high water, so as to admit of masted vessels sailing under it. Cubitt has also proposed to adopt wrought iron on a great scale, for constructing landing platforms at Liverpool, where the difficulty of building docks or quays, which large steam-vessels can approach at all times of tide, render works of this kind necessary to accommodate the immense traffic frequenting Liverpool. The landing platform designed by Cubitt, and now in course of construction, consists of a wooden frame, 500 feet long by 80 feet wide, floated upon a number of wrought-iron pontoons, each 80 feet long, 10 feet wide, and 6 feet deep; it is connected with the shore by two bridges, each formed of two hollow wrought-iron beams, 150 feet long, carrying the platform of the bridge; the attachment with the shore and the stage is so made as to admit of motion, both vertically and horizontally, to accommodate itself to the rising, falling, ebbing, and flowing of the tide, which there rises about 30 feet.

The invention of chain or suspension bridges is said to have been imported from China and India. The first of the kind in England was that across the Tees, at Middleton, consisting of two common chains stretched across the river, and secured to the adjoining rocky banks; the span was 70 feet. To Captain Sir Samuel Brown, however, who had previously brought chain cables into use for ships, may be attributed the introduction into England of the improved system of the bar link, which is now so generally adopted. Brown, in 1818, first constructed a large model of 100 feet span, capable of supporting a carriage and horses, indeed, adapted for general traffic. He afterwards constructed (1819), upon this principle, Union Bridge, for general traffic, across the Tweed, near Berwick; the span was 450 feet between the supporting towers, which were of masonry. He subsequently built another of smaller dimensions, across the Tweed, at Dryburgh. He also constructed that at Montrose, o[illegible] over the Hundred Feet River, in the Fe[illegible], and others, and applied the same principle with effect for landing-piers at Brig[illegible]on and Leith. This system was afterwards carried out to a far greater extent by Telford, in his great suspension bridge across the Menai, at Bangor, in 1818-20, so well described by Provis. It consists of three openings; the centre is 580 feet span, the deflection of the chain being 42 feet, and the two side openings are 260 feet span each, the platform of the roadway is 100 feet above high-water mark; the sustaining towers of masonry are 50 feet above the roadway, and are connected to the shore by three stone arches on one side, and four on the other, 52 feet 6 inches span each. There are 16 main chains 1770 feet long each, in sets of 4 each, suspended above each other, on each side of the roadway, which is 30 feet wide from out to out, divided into three parts, two for carriages, on the outside, 12 feet wide each, and one for foot-passengers in the middle, 6 feet wide. Each main chain consists of 5 bars or links, 10 feet long each by 3½ inches and 1¼ inches, connected together by plates and pins, on Brown's system, the whole being properly secured to the solid rock on each side. The total suspended weight of the main opening is 644 tons. About the same time he constructed another, upon similar principles, 300 feet span, across the river Conway, at Conway. These are fine works, and will remain as lasting monuments to his fame. The recent structures of Hammersmith, across the Thames, and Shoreham, across the Adour, by Tierney Clark, who is now erecting another upon a grander scale, 700 feet span, across the Danube; and lastly, that of Brunel, across the Thames at Hungerford Market (1845), show the progress made in this class of structures, which are well adapted for crossing large and deep rivers where economy is an object; great care, however, is necessary in proportioning the strength of the chains and their curve; the selection and manufacturing of the iron for them, and also in the connection and bracing of the roadway platform, in order to insure the greatest strength and solidity of construction; of this, the improvements to the Montrose Bridge, by Rendel, is a good example, and the system should be generally followed, as several disastrous failures have occurred from neglect of these important particulars.

Amongst variations of the system, that of Dredge may be mentioned.

The wire suspension system, although in extensive use on the continent, the largest example of which is at Fribourg, in Switzerland, where a bridge has been constructed of 800 feet span, for carriages as well as foot passengers, has been rarely used in this country. Although economical in the first cost, it requires constant attention, and it scarcely possesses sufficient durability for permanent structures.

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RETROSPECT OF THE PROGRESS OF STEAM NAVIGATION.—CONCLUDED FROM P. 47.

[From the Address of Sir John Rennie to the Institution of Civil Engineers.]

Much discussion has already taken place, and is still going on, as to the best form and dimensions of propellers; nothing, however, but careful and well-conducted experiments can determine this important point. In these investigations Rennie has taken a leading part; Smith, Lloyd, Sunderland, Barlow, Guppy, Brunel, Airy, Maudslay, Field, Miller, Barnes, Penn, and others have also done a great deal. Up to the present time the double-bladed propeller has produced as good a result as any other form. In the first application of steam power to screw, or stern propelling, cog-wheels were usually employed to drive the propeller; then straps, or bands, working upon wooden or iron cylinders; and in the *Great Britain*, endless chains were employed; in this case, however, the chain had claws, resembling teeth, attached to it, which fitted into corresponding recesses or cavities on the drum, and, to a certain degree, prevented the stretching or slipping to which chains of the ordinary description are liable; adhesion wheels were also tried by Messrs. Rennie, but were not found so good as cog-wheels. Latterly the system has been much simplified, by applying the piston of the engine to act directly upon the propeller shaft, and a successful result appears probable. Whilst upon this subject, the *Great Britain*, the largest vessel constructed in modern times, must not be omitted. She is 322 feet long, 50 feet 6 inches beam, draws 16 feet of water, and is 3444 tons burthen. She is propelled by the screw, with a pair of engines of the united force of 1000 horses power; there are four cylinders, inclining at an angle of 60°, and parallel with the keel; the pistons act by means of cranks upon a large wheel, which turns the drum with the chain and propeller shaft; the diameter of the screw is 15 feet 9 inches. She left Bristol on her first trial on the 8th January, 1845; and on the 23rd of the same month, for London and Liverpool,—for New York on the 26th July, 1845, and reached that city on the 10 August; left New York on the 30th of August, and reached Liverpool on the 15th September. This vessel and her machinery may be considered as a great experiment, from which useful results may be expected. She has already made two voyages across the Atlantic; and, notwithstanding the prognostications of many as to her failure, according to the report of her able and experienced commander, Captain Hosken, has answered well as a seaboat. Since then her engines and machinery have undergone certain modifications, and some trifling alterations have also been made in the vessel, which experience has proved to be necessary, and which, from the novelty of the construction, and the great scale upon which the experiment was tried, might have been expected, and for which every allowance should be made. These alterations have improved her materially; and it is greatly to be desired that so much labour and expenditure should be attended with complete success. This gigantic structure, which has had the advantage of Brunel's assistance, is certainly bold, original, and in the right direction; for nothing but proportionable mass, power, and correctness of form, are calculated to contend with the heavy swell and gales of the Atlantic. It is by these and other well-conducted experiments, that we may look forward with confidence, at no very distant period, to the voyage between America and Europe, much as it has already been shortened, being still further reduced. The same may be said of the voyage between India and Europe, the importance of which cannot be too highly estimated.

The advantage of steam, as an auxiliary to sailing vessels in long voyages, the steam power being only applied in calms, or when the wind is unfavourable, is beginning to be generally felt; and numerous vessels are now being fitted out upon this principle. For this purpose the screw propeller, with the means of taking it out of the water and replacing it when required without stopping the vessel, appears peculiarly well adapted; for whilst it enables the vessel to retain all her sailing qualities, as well as her capability for stowing cargo, it still gives her the advantage of steam power when necessary. The steam power, as it is not intended to be the chief agent, should be compressed into the smallest practicable space, still so as at the same time to give the greatest power: in order to effect this, tubular boilers of the most improved construction and power of evaporation; direct-acting engines, in which wrought iron is substituted for cast iron whenever it is practicable, using sufficient steam of a greater density, together with ample stowage for fuel to last for the average probable time that steam power may be required, must be used. By the judicious combination of steam with sailing, the time of long voyages may be materially reduced, and at the same time considerable saving may be effected in the transport of merchandise.

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THE TITHE COMMUTATION SURVEY.

Sir,—Absence in a distant country for the last two months prevented my seeing your Magazine, No. 1208, till now. Your correspondent, "A. B.," or rather, I should say, Captain Dawson, under that signature, has, I observe, again charged me with wilful falsehood. It would have been well if the Assistant Commissioner had advanced some proof in support of his charge. Has he done so? With respect to the instance I adduced of the Commissioners having returned a map, and refused or declined to explain in what particular they considered it erroneous, I did not say that the surveyor declined to have it tested on the ground, or in any other way admitted that his work was incorrect; on the contrary, he was perfectly ready to submit to the test. The landowners, however, did not think proper to make an addition of 30*l.* or 40*l.* to the already enormous expenses incurred during the five years to which the business had been protracted by the most vexatious delays; but which, I am ready to admit, were not all to be attributed to the Commissioners. They therefore resolved to take the map as a second-class survey, finding, that in fact the document when tested would be no more available as evidence in any matter, except the tithe commutation, than before.

Your correspondent asserts, that "the means whereby an examination of the map could be made in the office, and the errors, if any, detected, had not been supplied." This is an assumption not warranted by any statement of mine, and I must take leave to deny it. The printed instructions of the Commissioners had been strictly complied with. Supposing the fact, however, to have been otherwise, and that some irregularity in these respects had taken place, in common courtesy, in answer to the inquiry of the landowners, Captain Dawson should have stated what the deficiency or irregularity was. Gentlemanly conduct, courteous behaviour and language, form no part, however, of the qualifications of an Assistant Tithe Commissioner, and recent events have shown that these things are little attended to at Woolwich, and are therefore, I presume, not considered desirable in a Captain of Engineers. That Captain Dawson "*did all he could to carry out the plan which Glevum and Centurion concurred in alleging it was his duty to do*," is a matter of which the profession and the public are the best judges. There is one thing, however, that appears rather an extraordinary proceeding on the part of a person so anxious to procure an accurate survey of the kingdom, of the great public utility of which all are agreed. It does seem odd, that Captain Dawson, if he really had such sentiments, should step out of his way to offer the landowners to procure surveyors to carry on the work at such prices, that he must have known, if he knew anything about such business, no man, if he did his duty properly, could gain much more than labourer's wages. Thus most effectually shutting out all the most competent of the profession from any participation in the survey. Cheap articles are proverbially worthless, and so it has turned out in the instance before us.

Your correspondent gives me credit for being "well versed in the practice of the department to which my strictures have been applied." If he thinks so, my observations ought to have more weight; but I am not a surveyor, and I have already stated that I have never had anything to do with Tithe Commutation or Poor Law Commissioners' surveys, maps or plans. Nevertheless, I do understand land surveying, both theoretically and practically, quite as well as the Assistant Commissioner, of whose "*public conduct as a public servant*" I know nothing, except what relates to the Tithe Commutation Surveys; but I may observe, that offices under government are not always bestowed on those best calculated to perform the duties of them. I can therefore readily admit, that the gentleman in question might have been a very efficient officer of the public in some other department, although in that of Assistant Tithe Commissioner, I am of opinion, with many others, that he is misplaced. Here, then, I leave him, sincerely hoping that the next situation he fills may be one where his abilities may be exercised more to the advantage of the public and his own reputation.

I am, Sir, &c.,

GLEVUM.

January 8, 1847.

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THE NATIONAL ECONOMIC GAS BURNER.

[Registered under the Act for the Protection of Articles of Utility. Wm. Franks and Wm. Paul, Proprietors.]

Fig. 2. Fig. 1.

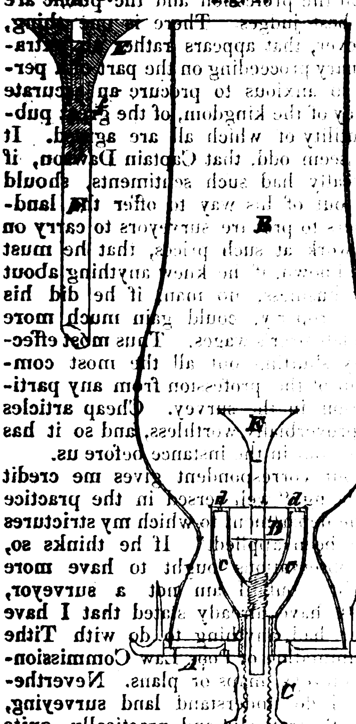

Fig. 1 is a sectional elevation of this new burner. A is the gallery; B the glass, which swells out at the parts immediately surrounding the flame, in the peculiar manner shown. C is the gas supply-pipe, from which two branches, c c, lead to the burner D, which has a single circlet of holes, d d. E is a flame-spreader, or button, of an inverted bell shape, which, instead of being hollow like those most in vogue, is solid, and fits by a small orifice, made through the centre of it, on to the top of a solid stem, F, and rests on a shoulder of the stem at f, as shown more clearly on an enlarged scale in fig. 2. The stem F is screwed at the lower end into the throat of the gas supply-pipe, and extends downwards a considerable way into the body of that pipe, so as to divide the inflowing stream of gas, and cause it to spread around it in its passage upwards.

The advantages attending this form of burner are very fully stated in a prospectus of the proprietors in the advertising columns of our present Number, to which we beg to refer the reader.

The superior "brilliancy of effect, intensity, and power" claimed for it we have ourselves witnessed, and can unreservedly vouch for; and resulting as those qualities must necessarily do from "perfect combustion," or a very close approximation to it, it is a matter of fair and reasonable inference that there must also be a great "economy of light" in the employment of this form of burner. The previous heating of the gas, by means of the solid button and stem, before reaching the point of ignition, is a very philosophical conception, and not, perhaps, sufficiently insisted upon in the prospectus of the inventors.

THE "QUESTIONS IN COOLING."

Sir,—You were pleased in No. 1190, for the 30th of May last, to publish my "Questions in cooling." I was curious to know if any experiments had been made to ascertain the relative degrees of cold in ice, and of the time required for the liquefaction of a block of Wenham ice, compared with an equal mass of ice frozen at the ordinary temperature of the winters in this country. I have since learnt that "*long before the Lower Canada ice has melted, the English ice has been converted into lukewarm water.*" As the information will, I have little doubt, be interesting to many of your readers, and as new to them as it was to me, you may be disposed to devote a column of your Journal to the following extract from Sir F. B. Head's *Emigrant*:

"*The Wenham Ice.*—I have often been amused at observing how imperfectly the theory of ice is, practically speaking, understood in England. People talk of its being "as hot as fire," and "as cold as ice," just as if the temperature of each were a fixed quantity, whereas there are as many temperatures of fire, and as many temperatures of ice, as there are climates on the face of the globe. The heat of boiling water is a fixed quantity, and any attempt to make water hotter than "boiling" only creates steam, which flies off from the top exactly as fast as, and exactly in the

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proportion to, the amount of heat, be it great or small, that is applied at the bottom.

"Now, for want of half a moment's reflection, people in England are very prone to believe that water cannot be made colder than ice; and, accordingly, if a good-humoured man succeeds in filling his ice-house, he feels satisfied that his ice is as good as any other man's ice; in short, that ice is ice, and that there is no use in anybody attempting to deny it. But the truth is, that the temperature of 32° of Fahrenheit, that at which water freezes, is only the commencement of an operation that is almost infinite; for after its congelation, water is as competent to continue to receive cold as it was when it was fluid. The application of cold to a block of ice does not, therefore, as in the case of heat applied beneath boiling water, cause what is added at one end to fly out at the other; but, on the contrary, the extra cold is added to and retained by the mass, and thus the temperature of the ice falls with the temperature of the air, until in Lower Canada it occasionally sinks to 40° below zero, or to 72° below the temperature of ice just congealed. It is evident, therefore, that if two ice-houses were to be filled, the one with the former, say Canada ice, and the other with the latter, say English ice, the difference between the quantity of cold stored up in each, would be as appreciable as the difference between a cellar full of gold and a cellar full of copper; in short, the intrinsic value of ice, like that of metals, depends on the investigations of an assayer—that is to say, a cubic foot of Lower Canada ice is infinitely more valuable, or, in other words, it contains infinitely more cold than a cubic foot of Upper Canada ice, which again contains more cold than a cubic foot of Wenham ice, which contains infinitely more cold than a cubic foot of English ice; and thus, although each of these four cubic feet of ice has precisely the same shape, they each, as summer approaches, diminish in value—that is to say, they each gradually lose a portion of their cold, until, long before the Lower Canada ice has melted, the English ice has been converted into lukewarm water. The above theory is so clearly understood in North America, that the inhabitants of Boston, who annually store for exportation immense quantities of Wenham ice, and who know quite well that cold ice will meet the markets in India, while the warmer article melts on the passage, talk of their 'crops of ice' just as an English farmer talks of his crop of wheat."

I am, Sir, yours, &c.,

TYRO.

LIST OF ENGLISH PATENTS GRANTED BETWEEN JAN. 7, AND JAN. 14, 1847.

Joseph Benoit Pierret, of Old Compton-street, Middlesex, engineer, for improvements in steam-engines. January 11; six months.

John Chubb, of St. Paul's Churchyard, London, and Ebenezer Hunter, the elder, of Wolverhampton, Staffordshire, lock-makers, for improvements in latches, latch-locks, and other locks for fastening. January 11; six months.

Douglas Pitt Gamble, of Crouch End, Middlesex, gent., for improvements in electric telegraphs. January 11; six months.

John Platt, of Oldham, Lancaster, machine maker, for certain improvements in the method of consuming smoke and economizing fuel. January 11; six months.

John Britten, of Liverpool, Lancaster, chemist, for certain improvements in machinery or apparatus for printing, ruling, and damping paper for various purposes. January 12; six months.

Lionel Campbell Goldsmid, of Rue Mogador, Paris, Esq., for improvements in applying rudders to ships and other vessels. (Being a communication.) January 14; six months.

John Fray Poole, of Bolton-le-Moors, Lancaster, book-keeper, for certain improvements in machinery or apparatus for spinning cotton and other fibrous substances. (Being a communication.) January 14; six months.

Joseph Seraphin Faucon, of Rouen, France, banker, for improvements in the manufacture of soap. January 14; six months.

Alexander M'Dougall, of Longsight, Lancaster, gent., for improvements in the manufacture of glue, and in treating products obtained in the manufacture of glue. January 14; six months.

Stephen R. Parkhurst, of Leeds, manufacturer, for improvements in rotary engines. January 14; six months.

Advertisements.

A Challenge to the World!!!

THE NATIONAL ECONOMIC GAS BURNER.

Registered according to Act of Parliament.

For Perfect Combustion, Brilliancy of Effect, Intensity, Power, and Economy of Light,

THE NATIONAL ECONOMIC GAS BURNER

Bids fair to be numbered among the greatest benefits that Science has bestowed upon Mankind.

Before proceeding to detail the nature of this

Invention, it may be necessary to state briefly a few facts in the art of Lighting, which will better enable the public to estimate the value of the present improvement.

The artificial production and supply of Light during the absence of the Sun, unquestionably hold a distinguished rank among the most important arts of life. If we would for a moment suppose the privation of light, it would follow as an immediate consequence, that the globe which we inhabit would cease to be the habitation of man. The inflammable matters usually employed in furnishing us with artificial light,—such as Oil, Tallow, and Coal Gas,—however excellent they may be in their natural qualities, still require the aid of superior mechanical contrivance to render the flame which they produce perfectly luminous. When all circumstances are favourable to Complete Combustion, the flame is perfect. If this be not the case, part of the combustible body capable of furnishing the inflammable gas passes through the luminous flame unburnt, and exhibits the appearance of smoke; soot, therefore, always indicates an imperfect combustion.

In order to prevent this taking place, a combination of chemical knowledge and mechanical skill is necessary. The great diversity of form and variety of contrivances which are exhibited in the Lamps and Gas Burners used in the process of generating light, testify the attention and study which this important subject is entitled to; yet it is remarkable, that (with the exception of the celebrated ARGAND, and SIR H. DAVY, and some few others, whose valuable discoveries added largely to the previous information that existed on the subject,) but few really scientific men have directed their abilities to the investigation of the theory of artificial light. And this is the more remarkable, and the more to be regretted, when it is considered that there is no other branch of what may be termed Domestic Science which administers more extensively to the social comforts of civilized man.

It is obvious to any one who is practically conversant with the nature of artificial light, that a certain definite or exactly proportioned quantity of the oxygen of the atmospheric air is indispensable, in order to produce complete combustion. It is settled by chemists, that the greatest intensity of light is produced when the relative proportions of oxygen and hydrogen are two parts of the latter in weight to one of the former to form water; and six by weight (one atom) of carbon unites with sixteen by weight (two atoms) of oxygen to form twenty-two of carbonic acid (one atom). Now we cannot imagine that the ingenuity of man will ever accomplish such a perfect piece of mechanism as will extract from the atmosphere the precise complement of oxygen requisite to unite with the volatile gas which escapes from a burner. From a series of careful experiments upon various burners, however, the Inventors of the Economic Gas Burner are fully warranted in asserting that their New Burner has approximated nearer to perfection than any other.

It is well known that carburetted hydrogen, liberated from oil and coal by the application of heat, are incapable of yielding either a pure or brilliant light, unless a sufficient quantity of the oxygen of the atmospheric air is made to enter minutely into combination with the ignited gas. ARGAND was, we believe, the first who discovered the necessity for this combination of the inflammable gases; and the result of his reflections upon this subject was that happy invention of the ingenious lamp which bears his name. Previously to this discovery, an enormous waste of illuminating substances was occasioned by the imperfect construction of the lamp then in use. This fortunate application of atmospheric air satisfied ARGAND of the correctness of his theory with regard to what he had done, and left the field open to future improvers.

The vast amount of money annually expended in procuring combustible materials ought, certainly, to be a powerful inducement to scientific men to endeavour to invent such a Burner as will diminish this expenditure. It is for this purpose, as well as for the production of a purer, brighter, and more perfect light by the consumption of a *less amount* of gas than is now required for the production of an *inferior* light, that the Economic Gas Burner has been invented, and is now submitted to the public. In order to demonstrate the superior advantages that this new Burner possesses over ARGAND's and all other Burners, it is necessary that we explain in what respect they are deficient.

It will, no doubt, be admitted, that, in consequence of ARGAND's Burner being a uniform cylinder, only the external particles of the column of air which ascend towards the place of combustion, will actually combine with the ignited Gas; it is evident, therefore, the myriads of globules, or those imperceptible atoms of carbon or smoke which constitute the centre of this column, are carried with a velocity peculiar to a cylindrical body of air, beyond the vicinity of the combustion, and thereby escape without having been appropriated. It was established by SIR HUMPHRY DAVY while engaged in the invention of the Miner's Safety Lamp, that an unrestricted supply of atmospheric air, though it increased the heat, materially diminished the light yielded by coal gas. In all the gas burners the air is admitted, without sufficient limitation and regulation, both to the inner and outer surface of the flame.

Now in this newly-invented Burner, these great defects are obviated by the following adjustments:—A solid conical button is inserted into the inner air-channel, at a certain height from the top of the burner, which arrests and restricts the supply of air, and at the same time causes it to be diffused equally and regularly over the inner surface of the flame. The outer current is adjusted by means of a conical glass chimney. By this combination, the gas flame is placed between two streams of atmospheric air, nicely regulated to a proper amount, and distributed in the direction that is most highly favourable to complete combustion.

The Burner contains but one row of jet holes, not two and three rows, as some recently constructed burners do, which shows the unscientific principles of their arrangement; for how is it possible for the atmospheric air to get into the centre of the gas? It must be granted by every chemist that that is impossible. Then how is it possible for the gas to be consumed without a due admixture of oxygen? and there are no hollow stems nor hollow buttons, and mark, no fire holes, which are preposterous.

But there is another important arrangement in this new Burner, whereby (as is proved by the evidence of some of the first Engineers and Chemists of the day,) artificial light is thus produced, in greater quantities and of a better quality, than by any means heretofore known, and *at a saving of from 30 to 40 per cent.*

The merits of this invention, the result of protracted study and perseverence, and great expense, are to be found in the production of a Burner which produces *no shadow*, and consequently renders profitably available as much of the light as possible. The combustion being perfect, there is *no deposit o soot*, therefore no filthy black ceilings, *and no smell.* In proof of the extraordinary pureness of the light that it produces, it may be mentioned, *that shades and tints of colours may be distinguished by night as perfectly as by day,*—an effect that has hitherto been in vain desired.

Without any further verbal assurances on our part, we would desire the Public to judge for themselves. The splendour of its effect has commanded the admiration of all who have witnessed it: and in order that its merits may be yet more generally appreciated, we beg respectful to intimate that

It may be seen Burning from 11 *till* 8, *at*

PAUL AND CO.'S
NATIONAL ECONOMIC GAS BURNER OFFICE,
12, Leather-lane, Holborn.

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To Inventors and Patentees.

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LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1224.] SATURDAY, JANUARY 23, 1847. [Price 3d.

Edited by J. C. Robertson, 166, Fleet-street.

CORDES AND LOCKE'S ROTARY SCREW PROPELLING ENGINE.

Fig. 1.

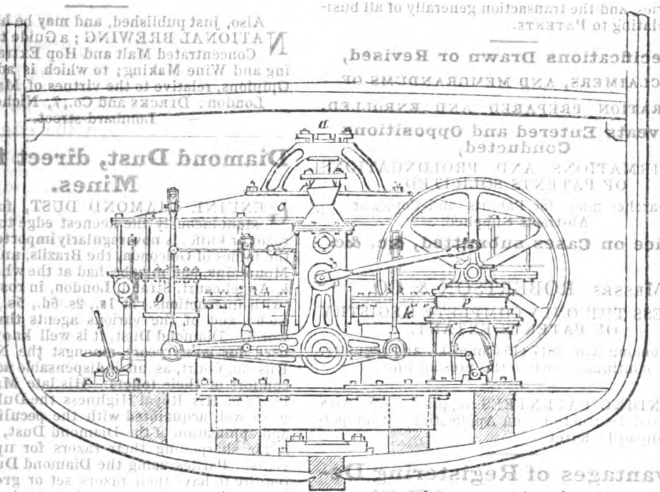
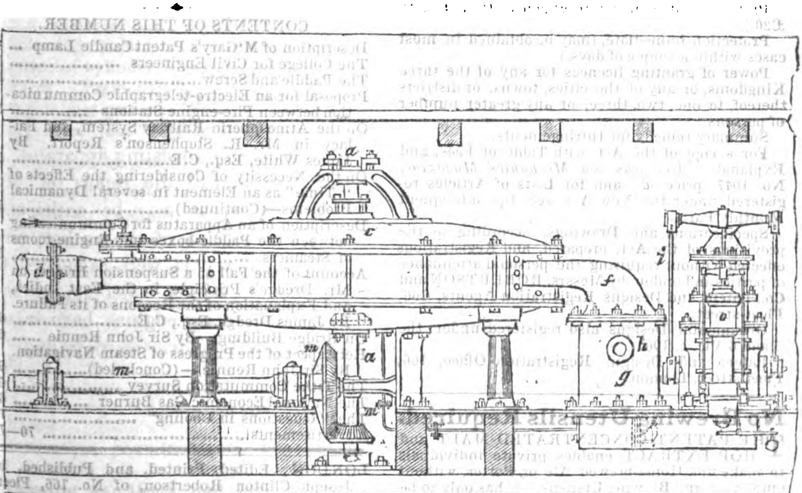


Fig. 2.



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CORDES AND LOCKE'S CONDENSING ROTARY STEAM-ENGINE.

When this form of engine was first patented, about five years ago, we gave an account of it in our pages, (see vol. xxxiv., p. 97.) Our attention has been now recalled to it, by the exhibition this week in the Grand Surrey Canal Dock of an engine of 30 horses power, which the patentees have erected in order to test the efficiency of their invention; and by a report on its merits by Mr. Josiah Parkes, C. E., dated the 5th inst., a copy of which has been obligingly sent to us.

The engine, now in course of exhibition, is shown as applied to the working of a screw propeller; and certainly this is as good a test as any by which the value of the rotary system of action can be tried—whether on Messrs. Cordes and Locke's plan, or any other. The engravings that accompany this notice are not, however, representations of the experimental engine referred to, but are intended to show what would be the arrangements proper to be adopted were Messrs. Cordes and Locke's invention actually applied to a screw steamer with horizontal engines of 150 horses power.

To save our readers the trouble of referring to our former account, we shall here state generally the manner in which the engine is constructed and operates. It consists principally of a wheel, revolving in an air-tight case, in open communication with a condenser, and provided with air-pumps for keeping up an exhaustion within the case. The wheel is somewhat like an overshot water-wheel, *and does not touch any part of the case.* It is turned round by a jet of steam issuing from the steam pipe of the boiler into the exhausted case, through a tube, which is inclined in the direction of a tangent to the circumference of the wheel, so that the steam impinges against the buckets of the wheel, and turns it round with great rapidity. The shaft of the wheel passes through stuffing-boxes at the centre of the circular case, and is supported externally by brackets, or otherwise; on one end of this shaft is a toothed pinion or pulley, for giving motion to the machinery which the engine is intended to work, and at the other end of the same shaft is a small bevil pinion, for driving the governor.

Fig 1 of the accompanying engravings is an end elevation.

Fig. 2, a side elevation.

a is the engine-shaft.
b, revolving wheel.
c, air-tight case.
d, steam pipe.
e, throttle-valve.
f, exhausting passage.
g, condenser.
h, injection-cock.
i, cold-water cistern.
j, hot-water cistern.
k, air-pumps.
l, jet pipes.
m, bevil-wheels.
n, propeller-shaft.
o, small steam cylinder.
p, framing of exhausting apparatus.

We give in full the report of Mr. Parkes. It is, as may be anticipated from the reputation of the author, very ably drawn; and is well calculated to shake the prevailing belief among engineers that rotary engines have in no case any advantage over reciprocating.

Mr. Parkes' Report.

Gentlemen,—Since the erection of your Patent Condensing Rotary Engine, at the Surrey Docks, Rotherhithe, certain imporatnt results have been obtained, from various and long-continued experiments, which place the value of the invention in so clear a light, that I will now proceed to a description of them in detail.

I must first state that this kind of engine precluded the employment of the indicator to ascertain its gross power, as in ordinary cylinder engines; and even if that instrument could have availed for the purpose, it was deemed to be of far greater importance to measure the amount of force actually disposable, as delivered off by the engine, rather than the power of the steam in action, which alone is denoted by the indicator. To attain this end it was necessary to fix upon some sufficiently uniform load to be applied to your engine, as well as upon some method of determining the resistance overcome. The load selected was a screw-propeller, submerged and driven round in a tank of water, 16 feet by 11 feet square. The resistance was weighed by Mr. Davies's dynamometer, adapted to a strap-pulley on a counter-shaft, working intermediate between the engine and screw-shaft.

These preliminary arrangements having been made, the engine was worked during several days; the quantity of water, as steam, which passed through the wheel case, as well as through the small auxiliary engine which drove the air-pumps, being carefully measured on each occasion. The resistance shown by the dynamometer was continually noted; the number of revolutions made by the wheel was exhibited by a counter; the pressure of the steam as it entered the wheel case, was observed on a thermometric steam-gauge: the value of the vacuum in the wheel-case was obtained by an ordinary gauge communicating with it; and the amount of power employed to drive the air-pumps and maintain the vacuum, was ascertained by an indicator. The diameter of the steam-wheel in question is 11 feet 7 inches, and at 502 revolutions per minute, its periphery travels at the rate of about 208 miles per hour. The width of the wheel-case is 15 inches; the number of vanes and radial arms 28; the breadth of each vane 6 inches, the depth 7 inches, and the area, therefore, of each vane about 42 square inches. The orifice of the steam-jet is of an oval shape, 3 inches by 2 inches, set vertically.

It appeared, after a great number of trials, that your engine gave the following results, when using steam in the boiler at a pressure of 2¾ lbs. per square inch above the atmosphere:

Revolutions of wheel per minute	502
Horses power per dynamometer	32
Vacuum in the wheel-case..............................	27·2 inches of mercury.
Water expended per horse power	100 lbs. per hour.

The same dynamometer and strap-pulley were then transferred to your works at Newport, Monmouthshire, and applied to a condensing engine made by Messrs. Bowman and Galloway, of Manchester, having the following principal dimensions, viz.: diameter of cylinder 30 inches, length of stroke 5 feet. Previously to the experiments, the engine was put into the best possible working condition. My indicator was applied to the cylinder; the dynamometer to the engine-shaft; cards were taken during several hours of continuous work, under an uniform load; the index of the dynamometer was noted down every five minutes; the water consumed, as steam, was accurately measured. The subjoined may fairly be considered to represent the mean result of numerous trials:

Speed of piston, per minute	220 feet.
Mean pressure per indicator..........................	10·342 lbs. per square inch.
Mean vacuum throughout stroke....................	10·186 ,,
Vacuum in condenser	26·5 in. of mercury.
Water evaporated per hour	3248 lbs.

The *indicated* power amounted, from the above data, to 41·78 horses; and the water expended for each horse power, per hour, to 66·65 lbs.

The *dynamometric*, or effective power, as denoted by the instrument, was 32·29 horses; and the water expended for each effective horse power, per hour, was 100·5 lbs.

It hence appears that the power actually delivered off by the cylinder-engine, was less than the gross or indicated power by 33·73 per cent.; and, that a similar useful effect was obtained both from the cylinder, and your rotary engine, with the same expenditure of steam and fuel.

The above experiments relate only to a strict comparison between the economy of your rotary, and of the common condensing engine, as distinct engines; but other experiments have been made to elicit the value and effect of the rotary when applied as an auxiliary to, or when combined with, the condensing engine, which I will now describe:

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One of the wheel or rotary engines, divested of its air-pump, condenser, &c, is connected at your works with a common reciprocating condensing engine, in the following manner:—The steam wheel is placed near to the cylinder of the condensing engine, in the same room, and is simply acted upon by the steam discharged from the latter. It therefore stands intermediate between the cylinder and the condenser, and derives all the power it gives off from the waste steam of the condensing engine, in its passage from the cylinder to the condenser.

Each engine drives a perfectly distinct load in the manufactory, that is to say, each drives sets of machines perfectly distinct, and in separate buildings; the power of the cylinder-engine being given off to a main upright shaft connected with one kind of machinery, and the power of the wheel engine applied to a strap communicating motion to machinery at a distance. This condition of things has existed in actual daily operation at the works for eighteen months past. In order to arrive at the separate value of the effect produced by each engine, and of their combined effect, the following methods of proof were adopted:

The usual loads were disengaged, and friction-breaks were applied in such manner as to balance the whole power delivered off by each engine. Indicator cards were frequently taken from the cylinder engine; each break was placed under the separate management of an experienced mechanic, with every provision to maintain uniform friction; the water evaporated was measured throughout the experiments. The results were,

Indicated, or gross horses power, of the cylinder engine	22·86
Effective horses power, as per break	15·70
Exhibiting a loss of about 31·32 per cent.	
Effective horses power, from the rotary engine, as per break	5·00
Water evaporated per hour	1800 lbs.
Giving for indicated horses power per horse per hour.	78·74 lbs.
Giving for effective horses power per horse per hour.	114·65 lbs.
Giving for combined effective horses power per horse per hour	86·99 lbs.

The dimensions of the cylinder engine were—

Diameter of cylinder	$19\frac{1}{4}$ inches.
Length of stroke	3 feet.
Speed of piston per minute	263 feet.
Mean pressure per indicator	10·1 lbs. per sq. in.

The dimensions of the rotary engine were—

Diameter of wheel	7 feet, 9 inches.
Number of vanes	30

Size of vane $4\frac{1}{2}$ inches wide, by 5 inches deep.
Two steam-jets, $2\frac{1}{2}$ inches diameter each.

The useful fact developed by these last experiments is the recovery of 5 horses effective power, in addition to 15·7 horses power from the same original steam, that is to say, steam which would otherwise have passed uselessly into the condenser, and been annihilated. It is, therefore, manifest that nearly one-third more power may be obtained from any cylinder engine by combining with it this rotary engine, without the use of additional fuel, boiler, or apparatus of any kind.*

With the view of proving that the auxiliary or supplemental wheel engine, as combined with the condensing engine, did not diminish the performance of the latter, the indicator and break were applied to it when working alone, the connection with the wheel engine having been shut off, and the waste steam suffered to pass through its usual pipe to the condenser. Under these circumstances the effective power of the condensing engine came out 15·637 horses, and the water expended as steam 115·1 lbs. per horse per hour; thus demonstrating that no diminution of its original power, nor increased consumption, were occasioned by its combination with the rotary engine.

* By reference to the coal account, during the last eighteen months, I find that a saving of 100 tons of coals has been effected within that period, by working the wheel in connection with the cylinder engine, whilst the power recovered from the cylinder engine has been more than equal to the duty performed by a separate engine, previously employed for that purpose only. And I also understand that the rotary has not cost 5s. in repairs during that time; that the packing, in the stuffing-boxes of the wheel-axle, has been but once renewed; and that nothing has occurred to require the case to be opened.—J. P.

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In order to prove that no opposition to the passage of the waste steam from the cylinder to the condenser is occasioned by the interposed wheel and case, the indicator was applied on the connecting pipe immediately in front of the jet holes, and the vacuum exhibited by it was in close accordance with the vacuum in the cylinder, as ascertained by the same instrument. The wheel-case is, in fact, a virtual enlargement of the condenser, and the value of the vacuum in the cylinder suffers no depreciation from its interposition. The power recovered and given off by the wheel is simply due to the steam's momentum—low as is its elastic force—acting by impact on the wheel vanes *in transitu* between the cylinder and condenser; the wheel working *in vacuo*, and therefore unresisted, or resisted only to the extent of imperfection of such vacuum. The more perfect the vacuum maintained throughout the case, the greater will be the useful effect obtained from the wheel.

In respect of the practical economy of your rotary engine, as regards steam and fuel, and as compared with the ordinary unexpansive cylinder engines, we know that the latter are not worked with less than 70 lbs. of water per horse per hour, and they much oftener reach or exceed 80 lbs., deduction being made of friction only when the engine is unloaded, which is very small. It appears, however, from the foregoing dynamometric and break experiments, that fully 30 per cent. should be deducted from the gross indicated power of the cylinder engine, as the value of its friction when loaded; or, in other words, that we realize less than 70 per cent. of the gross power; and the loss of effect when speed has to be quickly got up, as in the case of marine engines working screw propellers, most probably considerably exceeds 30 per cent. The consumption, therefore, of 100 lbs. of water as steam per horse power per hour by your engine, may be considered, in respect of economy, as placing it on an equally advantageous footing with the class of engines alluded to.

In other respects your invention displays self-evident advantages. The rotary engine is, unquestionably, remarkable for its simplicity, having neither valves, beams, rods, nor any parts subject to friction, excepting the journals of the axis of revolution, and these are of very small dimensions. I may mention, as some proof of the trifling amount of engine friction, as well as of the high momentum acquired, that on suddenly shutting off the steam with the screw in work, at the Surrey Docks, the whole machinery continued to revolve during seven minutes, the engine having made 700 revolutions before it came to rest. It is, however, brought to rest as quickly as any other engine, without risk or disturbance, by shutting off the steam and simply admitting a small jet of water on the vanes of the wheel. By this expedient the vacuum is preserved within the case, and the engine may, for marine purposes, be immediately reversed by admitting a full jet of steam on the opposite side of the wheel. Eleven seconds have sufficed to bring a wheel to a dead stand when making 540 revolutions per minute.

It is also important to notice that the power of your engine can be economically and conveniently communicated through the intermediation of a single pinion on the engine axis, geared into a wheel on the propelling shaft. The transfer of the power to the load will thus be accomplished with the smallest possible loss of effect; a result which arises from the velocity proper to your engine being greatly superior to that required by a steam vessel propeller.

JOSIAH PARKES.

11, Great College-street, Westminster,
January 5th, 1847.

COLLEGE FOR CIVIL ENGINEERS.—(CONCLUDED FROM P. 53.)

Perhaps the annals neither of decided lunacy nor of bold swindling—no, not even in railroad history—can exhibit a single specimen of absurdity transcending that displayed in the prospectus of "*The great National Institution of Engineers and Mechanics*," bearing the date of May 5, 1838. Colonel Jackson, subsequently to our strictures, published a statement in a cotemporary journal (the *Artizan*, June, 1846,) in which the original prospectus, and some other interesting information respecting the nefarious conduct of the early project, are collected together. It is a curious document and worthy of perusal for many reasons. Its great length is the only difficulty in our transferring it to our own pages; for we should have been glad to do Colonel Jackson the justice of allowing him to speak for himself. We adopt the only alternative in our power—recommending its perusal to our readers. In fact, to render some of our remarks entirely intelligible, a reference to it is essential. The number of pupils is to be "limited to two thousand;" and the "sons of mechanics of all descriptions may be bound appren-

tices to the establishment!" We should, however, do Colonel Jackson a monstrous injustice, did we not pointedly state that he was no party to this extravagant proposal: it is due to him to say that he pointed out most forcibly the absurdity of the scheme. What we think blamable in the Colonel at this stage of the proceeding, was his *dalliance* with parties either so reckless or so ignorant as to issue that prospectus; for to a judicious mind it must be evident that the concoctors of the scheme were unfit persons for co-operating with a man of honour and integrity. His first error was to notice the advertisement at all; his second and graver error was to personally enter into any scheme, however modified, that should connect him with a clique of such questionable honour. We can, and do, make all allowance for the very natural desire of a man of energy, without employment, to find out a field where he might meet with *remunerative* occupation — especially if, like Colonel Jackson, he be a man of active and stirring habits. His eagerness was his ruin, as regards this connection.

We say he dallied; he "touched the pitch and was defiled." He had a certain amount of the practical and the practicable in his imagination of the *beau ideal* of an educational institute. His military experience *must* produce this; and we consider his commentaries on the original scheme as being very judicious—had he confined them to his own writing-desk. The "mercenary character" of the original plan was too transparent to escape the detection of even a demi-idiot; and it required only a small share of Colonel Jackson's shrewdness to discover that in such a shape the project could never answer the "mercenary" purposes of the projectors. Did it never occur to the gallant officer, that however the scheme may be modified in the prospectus, the mercenary spirit must always attach to it whilst the originators were parties to its working? Could he believe for one moment that "a more taking prospectus," and even "a more practical plan," would ever divest the project of its "mercenary character;" or that *his* influence would eradicate the essential selfishness of the schemers to whom he was about to link himself? If he did, we pity his obtuseness; if he did not, can he deny being implicated in the charge we originally brought against the founders? Out of his own mouth he is condemned.

There was an air of business and a feasible shape given to the project, in the detailed scheme of Colonel Jackson. Yet, strange to say, he never took the precaution of having his own *status* accurately defined; at least such is his own account of the matter. It would appear that he had deemed himself paramount, and assumed that he was to be sole director of the undertaking; and that it was only when he found that another member of the council (a military engineer!) was countermining him, that he deemed it necessary to seek a definition of his position and his powers! He, poor simple soul, had not taken the precaution of "putting friends of his own on the council," whilst his rival had. Thus is innocent integrity ever rewarded. When the college was organised, (under its then new name, and the same that it still bears,) and a "scheme of study and employment of time" elaborated by Colonel Jackson, then he was told that he assumed too much in pretending "that it had been moulded in consonance with his views," and that the "council *unanimously refused to admit his claim.*" We must say that, if Colonel Jackson's statement be even approximatively correct and ingenuous, a more insincere and ungrateful set of men never composed any council or any committee. We will not, however, offer any decided opinion till we hear Mr. Horneman, Mr. Westropp, and Colonel Huchinson; for their explanations may possibly throw some further light upon the matter: but we own, that to our minds the bold front shown by Colonel Jackson and the ambush in which his opponents hide themselves, tell very strongly in favour of his version of this strange affair. We advise him, however, to forget his soldier-qualities, and restrain his temper; especially not to write quite so violently as he is in the habit of doing, when, in the exercise of a public duty, any editorial remark is made that is unpalatable to him.

It is time, however, to proceed to the main object of our last branch of the subject which it is our intention to notice in respect to the College for Civil Engineers—its systems of actual education, under its different "phases."

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Colonel Jackson has published his scheme, which he tells us was "fixed upon, after a diligent comparison of the practice abroad and the advice of the most experienced instructors." Of this scheme we can only say that we never met with one more entirely surfeited with quackery, or one more perfectly calculated to "turn out" a set of superficial and conceited dunces into the profession. No "experienced instructor," we are convinced, could have either suggested or approved such a singular medley of subjects for study in a single week as this table exhibits. It seems to proceed entirely on the "regimental detail for drills and service;" and, indeed, appears rather designed for keeping all the masters always employed, than for the purposes of efficient education. The arrangement and classification of the studies—and even the very terms employed—demonstrate that the author of the scheme was supremely ignorant of the natural order for the development of scientific truths; whilst many little indications may be detected which display a touch of the charlatan in education. Colonel Jackson, indeed, affirms that a military man is the best fitted for conducting a course of education, (see vol. xliv., p. 247,) but universal experience has shown the contrary, and certainly he is himself no exception to the rule.

One great error consists in the want of continuity of study of the principal elementary subjects. His system is composed of *bits*—a bit of one thing, then a bit of another, and so on; till in three days, or more generally in a week, comes another bit of the first, and the same round is again run. Every intelligent teacher, however, knows the utter absurdity of such a system—especially in respect to young pupils and the fundamental branches of science and literature. Had Colonel Jackson ever been employed in tuition he would have soon discovered that this discursive rambling over the field of knowledge was totally incompatible with the acquisition of real learning, however well calculated it may be "to make a show of doing something," and thereby filling his college with pupils, and paying a dividend to the shareholders. "Line upon line, and precept upon precept," is the doctrine of all good teachers; but Colonel Jackson, with that heaven-born intuition which invariably grows up under the epaulettes, despises civilian experience, even in matters of a purely civil character.

Again, the jumble of subjects put down for the same lecture, marks the gallant gentleman's superlative ignorance of their very nature; and the sometimes strange terminology of his syllabus shows that the "experienced instructors" were not always at hand to preserve him from "doing the ridiculous." For instance, we have, as an *after-dinner study* for one class, "Synthetical Statics and Integral and Differential Calculus;" in another, and a lower class, the "higher branches of mechanics, illustrated by models, &c.:" and the first class is employed at the same time in "the composition of memoirs," or "*grand* competition drawing." To say nothing of the time selected for these somewhat ambitious subjects, (after dinner,) which no person who viewed the human mind otherwise than as automatic, would have selected for study at all, we will ask whether such a jumble as synthetic statics with the integral and differential calculus was ever made by any reformer of education? What, indeed, does he mean by "synthetic statics?" and why, if he means statics treated geometrically, does he combine it in the same lecture with the calculus? And why, again, does he teach the integral calculus before the differential? Does he, again, suppose that "memoirs" on any subject can be composed in a class-room, or does he consider them mere school themes? His preposterous adoption of out-of-the-way terms, (such as caligraphy for common writing, &c.,) leaves us quite in the dark—the darkness of his own excessive light, perhaps, but still it is darkness—respecting his actual meaning, if meaning he really had. He also talks of "descriptive geometry" quite as a thing of course, and that at a time when the very term was only known to a few of the higher order of mathematicians in this country, and its principles, much less its applications, to a still smaller number. Most certainly, till very recent times, that important branch of engineering, mathematics, was totally unknown in the college at Putney, even as to its simplest and most elementary principles, and most ordinary practical problems. As, how-

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ever, we nowhere in his syllabus find the word "projection," we suppose he adopted the term "descriptive geometry" as a fine and imposing name for the very simple thing which he and his "experienced instructors" had in view.

As to religious instruction, it does not appear to have entered into Colonel Jackson's scheme of education; for even if it be alleged that this was the business of the chaplain, he has taken care to so fill up the time, that it would be difficult for that functionary to edge in a few words of instruction—except during the *dies non*, Sunday. There is no appointed time even for morning or evening prayers!

We have dwelt on this scheme of education more at length than it deserves, from remarking that the article in question throws out "a feeler" to ascertain whether the public will support the Colonel in the formation of a new college, as a rival to that at Putney. We do it principally to call his attention to the defects and blunders of his own prospectus, if so published, and under the hope that, if he make the attempt, he will first consult some "experienced instructor" of a different class from those whom he previously consulted, and, what is more, take the advice which such a one may tender. Of course, he will this time secure a council more tractable than his original one; and if he shall still adhere to his published syllabus, his scheme will at least obtain a trial,—though, like most schemes, it will be tried at the expense of her majesty's lieges.

We have dwelt more at length on Colonel Jackson's scheme of education than it may appear to many of our readers so visionary a project deserves. Yet we consider that the pompous and confident tone of the framer is calculated to impose on parents and the public so far as to lead them to condemn any material departure from it, which might have been made during subsequent "phases" of the college; and it became, therefore, necessary to urge one or two considerations in proof of its being unsound in principle and inapplicable in practice—in short, more showy than real, more wordy than intellectual. We could add a great deal more, were it worth the trouble.

The system pursued after the retirement of Colonel Jackson and the opening of the college, may be easily inferred from the too general character of the class of teachers who were employed under Colonel Hutchinson, as we have already described them, (vol. xliv, p. 325,) although that very scientific person, we believe, adopted in a great degree the details of the syllabus, and certainly the principles of military government which were laid down by Colonel Jackson. The whole college became a bear-garden, the masters were perpetually changed, the details of instruction were followed out in the most desultory and irregular manner possible, and universal anarchy and disgust spread alike amongst the pupils and the professors. Study! it is sheer mockery to talk of study under such circumstances. The event, too, justifies the prediction which any man of ordinary understanding would have founded on these premises. The college rapidly went from bad to worse, and to worse still, till, under Mr. Page, it had arrived at its *maximum* of degradation, both as to character and learning. Mr. Page will not himself, we are persuaded, deny that at Midsummer, 1844, the college was in a state of total disorganization,—that it was totally without definite regulations as to subjects of study, amount of acquirement, or the time which should be reasonably allowed for the acquisition of each,—that too many subjects were contemporaneously crowded upon the students' attention,—that, though the college had uniformly professed to grant diplomas to the students, yet at the end of the fourth year of its active existence, no definition of the conditions which would be considered a qualification had been laid down,—that no defined amount of progress was required of any student as the *minimum* for a year's work, in order to ascertain whether it was desirable or just to retain him in the college from either his idleness or incapacity.* Or, again, will he deny that nearly all the subjects enumerated in the college programme of that period, except the

* At the time to which we refer, no lectures were given in *physics*, in *mechanics*, or in *chemistry* in the college! Even Professor Harman Lewis's mathematical class was composed of *twelve* students: "the subject—the differential calculus, which some do not learn." This same Mr. Lewis combined in his own person the professorship of *mathematics*, of *physics*, of *mechanics*, and of *chemistry*; salary £400 per annum, with board and residence; his duties, ten hours per *week*. He has lost a good berth by the break-up of the system.

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most elementary, were totally neglected? Yet we have before us the printed questions of that year, from which it would appear that not only was every branch of mathematical and physical science studied in the college, but that very advanced progress had been made in every one of them!—Dust, indeed, for the public eye!

We could ask Mr. Page some further questions, and much more in detail, were it worth while to do so; and such as he must answer (for we will assume that he would answer honestly) to the disadvantage of the college management at that time. We do not impute the fault to Mr. Page, but to the impertinent interference of the council and the muddle-headed directorship of his predecessor, that such a state of things existed. We only blame him for taking upon himself the responsibility of it, without making a firm stand with respect to a corresponding independence of action. He had been chaplain from the beginning; he was not ignorant of the intrigues by which the college had been brought to the verge of bankruptcy, both of honour and purse—he could not have been taken by surprise, or deluded by verbal promises: in short, no plea can be urged in his favour, but that he was intoxicated by a little ephemeral popularity with the students, and a large dependence upon his own powers to still the troubled waters.

We feel, however, that we should be doing a great injustice were we not to make it clearly understood that even during the worst times of the college history, there were a few men engaged in its educational department who endeavoured, as far as such circumstances permitted, to contribute to the best interests of the institution—who kept aloof from the broils that existed around them, and solely devoted their energies to the conscientious discharge of the duties they had undertaken. Happily, most of these remain attached to the college; and those who are not, only left it for higher and more lucrative appointments.

Of the present "phase" of the college little need be said that has not already been implied in our former articles on the subject, yet it may be desirable, as it is certainly but just, that we should add one or two closing remarks.

The Principal, Mr. Cowie, instead of assuming a post of powerless responsibility, demanded and obtained an absolute and independent control over the entire arrangements of the college, unshackled in all his proceedings, and answerable only for the final results of his administration of its affairs. He found the finances of the college in the most desperate condition; and he has made the income more than cover the current outlay. He found the morals and character of the college in the most discreditable condition—a low sense of honour, and no respect for religion or the laws. He has generated the tone of gentlemanly feeling and social decorum, as well as a respect for things venerable and sacred amongst the students. He found the studies of the college a mere farce and idle pretension; he has rendered them efficient for the professional and general objects to which the college is devoted. He is a man of science himself, having been the senior wrangler of his year; and knowing what science is, and where to find it, he has sought and obtained the highest scientific co-operation that London afforded. The disputes and jealousies that arise amongst men of limited acquirements, are effectually excluded from the walls of the coll ge; and the mean intrigues of its former history can never, under such superintendence, be revived at Putney. Great pretensions to superior education were formerly made; now the pretensions are strictly limited to the objects which can be, and which actually are, accomplished. Charlatanism has given way to learning, and bombastic profession to modest performance.

Of the course of study we need say nothing beyond this — that in every branch of natural, experimental, practical, and mathematical science, that is either necessary or useful to an architectural and engineering education, the students are effectively trained. Nor are the studies which are strictly professional either neglected or slurred over in the college course; the essential principles of construction, machinery, and mechanism, being most ably developed, illustrated, and enforced.

Colonel Jackson is pleased to designate such an institution as merely a "respectable academy" (*Artizan*, June, 1846, p. 117) "fallen from the high estate" to which *he* raised it. He raised it, indeed! He, according to his own showing, (*Mech.*

Mag., xlv., p. 236,) never even opened the college; and his raising consisted solely in the share which he took in the concoction of the scheme, and the formation of that singularly absurd syllabus of studies to which we have adverted! Does the Colonel know the meaning of plain English words; or does he think that such random idle assertions as he makes will be accredited on his authority in the teeth of common sense, and of the clearest evidence? Its "high estate" was, at his recession, simply that of a commercial job in embryo—a mere invisible "atomy," which the obstructive skill of his brother-soldier ushered into life—

Monstrum horrendum, informe, ingens.

Whether another college for civil engineers be a *desideratum* or not, we shall not spend much time to inquire; but could such an institution be founded to secure equal advantages to the student upon a considerably reduced scale of charges, it would meet our hearty concurrence, and receive our best support. It behoves those, however, who may seriously contemplate the foundation of such a college, to stop and count the costs. Till the college at Putney came into Mr. Cowie's hands, the annual expenses exceeded the income—sometimes considerably. Even now, the clear income of the institution is but small; though, we believe, steadily increasing. To this there must be a limit; for it is doubtful whether the outgoings can be much further diminished without impairing the efficiency, or lowering the respectability of the college. At all events, diminished terms must be attended with a lower scale of comfort to the students, and a lower grade of professional talent, —as well as with a far lower amount of collegiate advantages for study. We do not discourage the attempt to found another college; we only wish its projectors to go to work with their eyes open, and to make their arrangements in conformity with the experience of similar institutions.

ON THE CALCULATION OF THE SUMS OF THE POWERS OF THE NATURAL NUMBERS.

It has been proved by simple subtraction, without any reference either to the method of increments or to that of differences, that the sum of n terms of a series of the form

$$1.2.3.\ldots + 2.3.4.\ldots + 3.4.5.\ldots + \ldots + n\,(n+1)\,(n+2)\ldots$$

is expressed by writing down the general term with an additional factor, and dividing it by the figure denoting the number of factors thus written.* For instance, the sum of the series

$$1.2.3. + 2.3.4. + 3.4.5 + \ldots + n(n+1)\,(n+2)$$

$$\text{is } S = \frac{n(n+1)\,(n+2)\,(n+3)}{4}.$$

In like manner the sum of the series

$$1.2.3.4 + 2.3.4.5. + 3.4.5.6 + \ldots + n(n+1)\,(n+2)\,(n+3)$$

$$\text{is } S = \frac{n(n+1)\,(n+2)\,(n+3) + (n+4)}{5}.$$

And so on to any extent.

This simple theorem, which requires no effort of memory may be advantageously applied to the investigation of formulas for the sum of the squares, of the cubes, &c., of the consecutive whole numbers. The methods usually employed for the determination of these sums are not only lengthy and troublesome, when the powers are rather high, but they are moreover destitute of all principle of dependence, by which the process for the inferior powers might assist in calculating the sums of those of higher order. I have therefore thought that it might perhaps be acceptable to some of the readers of this Journal to be furnished with a mode of treating such series, that would render the calculation of the lower powers in some degree subservient to the discovery of the sums of

* See the 4th edition of the author's Algebra, p. 260.

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the higher; and which would at the same time make no demand upon any of the advanced theories of algebra. The method suggested will be sufficiently understood from the following examples of its application:

1st, $1+2+3+4+5+\ldots\ldots+n.$

By the theorem above,

$$S=\frac{n(n+1)}{2}.$$

2nd,

$$1^2+2^2+3^2+4^2+5^2+\ldots\ldots+n^2.$$

Here $n^2=(n-1)n+n$. Consequently, by the theorem,

$$S=\frac{(n-1)\,n\,(n+1)}{3}+\frac{n(n+1)}{2}$$

$$=\frac{n(n+1)(2n+1)}{6}.$$

It may be remarked here, that there was no necessity to reduce the two fractions, immediately furnished by the theorem, to one; as they are as fully favourable for arithmetical calculation in their separate state.

3rd, $1^3+2^3+3^3+4^3+5^3+\ldots\ldots+n^3.$

Here, as before, we shall only have to write down as many binomial factors, having 1 for their common difference, as there are units in the exponent of the power before us, and then to introduce the correction necessary to reduce their product to equality with the general term: thus,

$$n^3=(n-1)\,n\,(n+1)+n$$

$$\therefore S=\frac{(n-1)\,n\,(n+1)\,(n+2)}{4}+\frac{n(n+1)}{2}$$

$$=\frac{n(n+1)}{2}\left\{\frac{(n-1)\,(n-2)}{2}\right\}=\left\{\frac{n(n+1)}{2}\right\}^2.$$

4th, $1^4+2^4+3^4+4^4+5^4+\ldots\ldots+n^4$

$$n^4=(n-1)\,n\,(n+1)\,(n+2)-2\,n^3+n^2+2\,n\;;$$

and, as already determined,

$$-2\,n^3+2\,n=-2\,(n-1)\,n\,(n+1)$$

$$n^2=(n-1)\,n+n$$

$$\therefore S=\frac{(n-1)\,n\,(n+1)\,(n+2)\,(n+3)}{5}-\frac{(n-1)\,n\,(n+1)\,(n+2)}{2}+\frac{n(n+1)}{2}.$$

It would be waste of labour to add these fractions into one, before proceeding to the arithmetical calculation; since they are better suited to numerical computation in their present form.

5th, $1^5+2^5+3^5+4^5+5^5+\ldots\ldots+n^5$

$$n^5=(n-2)\,(n-1)\,n\,(n+1)\,(n+2)+5\,n^3-4\,n\;;$$

and, as already determined,

$$5\,n^3-4\,n=5\,(n-1)\,n\,(n+1)+n$$

$$\therefore S=\frac{(n-2)\,(n-1)\,n\,(n+1)\,(n+2)\,(n+3)}{6}+\frac{5\,(n-1)\,n\,(n+1)\,(n+2)}{4}+\frac{n(n+1)}{2};$$

which, as before, is already in a form well suited for calculation.

These examples will suffice to show the simplicity and universality of the method. Its main feature consists in decomposing a power into a series of terms of which each consists of factors in arithmetical progression, and of doing this without the aid of indeterminate co-efficients, the introduction of which greatly increases the symbolical work, and often fails to furnish results of an equal degree of simplicity to those above. The method, it is plain, is equally applicable to the decomposition of every rational and integral polynomial; and will be found to be always preferable to the operation for the same purpose by indeterminate co-efficients. I need scarcely add, that this short paper is solely intended for young algebraists: more especially for those who may have felt any difficulty in that part of the subject relating to piles of shot. The formula for a square pile is given above; that for a triangular pile is deduced at once from

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the fundamental theorem, which, for the sum of double the number of shot in the pile, viz.:

$$1.2+2.3+3.4+\ldots+n(n+1), \text{ gives}$$

$$\frac{n(n+1)(n+2)}{3} \therefore S = \frac{n(n+1)(n+2)}{2.3}.$$

And as a rectangular pile, having n shot in the shorter side of the base, and m more in the longer side, is obviously

$$1^2+2^2+3^2+\ldots+n^2+m(1+2+3+\ldots+n),$$

the entire number of shot, by the same method, is

$$S = \frac{(n-1)n(n+1)}{3} + \frac{n(n+1)}{2} + m\frac{n(n+1)}{2}$$

$$= \frac{(n-1)n(n+1)}{3} + \frac{(m+1)n(n+1)}{2}$$

$$= \frac{(3m+2n+1)n(n+1)}{2.3}.$$

J. R. YOUNG.

Belfast, January 15, 1847.

Some useful remarks by Professor De Morgan and Mr. Cockle have recently appeared in the pages of this Magazine, on mathematical nomenclature. The worst fault however in the nomenclature of any science is the fault of ambiguity; and this very much prevails in the subject of series. Thus, the terms *diverging* and *converging*—as applied to infinite series—have not hitherto been used in any uniform and definite sense by analysts. Hutton called the series $1-1+1-1+$ &c. *neutral;* because, to use his own words, "it is neither convergent nor divergent." Cauchy, however, calls it a *diverging* series. (Cours d'Analyse, page 126). Poisson properly denominates $\cos x - \cos 2x + \cos 3x - $ &c., a *periodic* series; but Abel, as also his commentator and editor Holmbac, says that it is *divergent* for all values of x (Œuvres, tom. ii., p. 280.) It is surely sufficient, as marking the peculiar and distinctive character of a diverging series, to say that its sum is an indeterminate infinite; or, as it is usually expressed, that it has no sum—not even a determinate infinite. This, of course, cannot be affirmed of the series above, whatever be x: when $x=0$, the sum is ambiguously 1 or 0. I have entered more fully into this matter in a paper sent several months ago to the Transactions of the Cambridge Philosophical Society, and which will be shortly published either in that work, or elsewhere.

PROGRESS OF MACHINERY.

[From Sir John Rennie's Address to the Institution of Civil Engineers.]

The improvement and extension of machinery and manufactures by new inventions and applications have been immense since the time of Smeaton. Previous to that period wood was almost exclusively used in the construction of machinery. Desaguliers, Leupold, Gravesande and other writers, have given descriptions of the best specimens of mills and machinery in use a century ago, but they were very defective, both in proportion and construction, when compared with modern machinery for similar purposes. The introduction of cast iron by Smeaton, in 1754, was a great step in advance. He began by employing cast iron for the axis of one of his earliest windmills, in 1754; then in 1769, for the shaft of a water-wheel, and the main-wheel attached to it, for boring cannon at Carron; cast iron afterwards was generally adopted for axes, but as some of them, which were improperly made, gave way, the application of cast iron in other machinery was in some measure retarded, until Watt applied his steam-engine to drive mills. The Albion Mills, constructed by Rennie, in 1784, and worked by Watt's steam-engine, may be considered as the first complete example of the employment of iron in every part of machinery, except for the teeth of some of the wheels, which were made of hard wood, for working into the iron teeth of other wheels; that example also showing the true form of teeth, with a fine pitch, and adequate depth and breadth and adjustment with each other, so as to work well together

with the least friction, and the use of bevil gear, which is the perfection of modern millwork.

The great improvement effected in the design, proportion, and construction of millwork, together with the steam-engine, enabled machinery to be driven with greater velocity, increased action, and diminished friction, and thus greater effect was produced with the same amount of power.

We are indebted to our honorary member, Professor Willis, for his able investigation of the teeth of wheels; and to Whewell, Mosely, Jamieson, G. Rennie, (for his new edition of Buchanan,) and others, for their valuable treatises on mechanical and engineering subjects.

The invention of the spinning-jenny, by Hargreaves, in 1767, and of the means of drawing out the fibres of cotton between successive pairs of revolving rollers in the water-twist spinning, by Arkwright, in 1769, followed by his system of machinery for carding and preparing fibres of cotton for spinning, in 1775, occasioned a complete revolution in the arts of manufacturing, and led to the establishment of the factory system, with its self-acting machinery. A somewhat similar system had, however, been introduced in the silk mills at Derby, nearly half a century before; but inasmuch as silk naturally consists of a series of fine threads, it is only necessary to twist or re-twist them, in order to combine them together, which is a very simple operation, compared with forming the short detached fibres of cotton into a thread, without the aid of the hand to guide them; and to accomplish this by machinery was extremely difficult; it was, however, very ingeniously overcome by Hargreaves and Arkwright in different ways, both of which were combined together by Crompton, in the mule, in 1771. Arkwright's water-spinning was subsequently simplified into what is technically termed throstle-spinning, and together with his preparing machinery of 1775, was adopted for spinning worsted by Toplis, and for flax by Marshall. The carding machinery was also adopted, with suitable modifications, for preparing short wool, Hargreaves' spinning-jenny being used for spinning it into yarn for woollen cloth. The mule for a long while was only employed for cotton, but was adapted by Kelly in 1790, to be partly worked by power in aid of manual labour, and was soon after improved so as to spin extremely fine threads.

All these valuable inventions, together with a multiplicity of other ingenious contrivances connected with the factory system, were completed and brought into extensive use in the short period of twenty years. Machinery for printing calico was introduced by Peel, and perfected by others. Watt, in 1787, introduced chemical bleaching; which was afterwards carried to great perfection by Tennant. Cartwright, in 1787, invented cloth-weaving by power, although it was not brought into use until twenty years after; and, in 1790, he invented machinery for combing and preparing long wool, in preparation for being spun into worsted. Machinery for dressing woollen cloth by teazles was perfected, and Harmer invented machinery for shearing it in 1787. This has since been carried to greater perfection by Lewis. Bramah, in 1796, introduced the hydraulic press, which furnished the means of pressing cloth, books, papers, and other articles with a degree of force which could be accomplished by no other means; and its general adoption has been of great service. Self-acting machines for making button-shanks were invented by Heaton. Boulton's large manufactory at Soho contained many inventions besides those of Watt. He invented machinery for coining money by steam power in 1790, and erected a complete establishment at Soho, where, for a long time, he executed contracts for coining money for the British and various foreign governments. His plan for stamping the pieces consisted in exhausting air by pumps, worked by a steam-engine, from vessels properly adapted for the purpose, and connected by valves with air cylinders, having pistons working the balance beams of the coining-presses. By opening a valve, air is exhausted from within the cylinder, and the atmospheric pressure acting upon the piston, turns down the screw of the press which stamps the coin; by re-admitting air, the piston rises and with it the screw, thus producing an alternate rising and falling motion so as to strike from 50 to 60 pieces per minute; as the screw rises and falls, it works a feeding apparatus for supplying blank pieces, ready prepared for stamping, and as fast as one piece is stamped it is pushed off the die, and is replaced by another. The apparatus for cutting out the blank pieces is of a similar description; the whole is self-acting, and is a most beautiful and ingenious contrivance. These improvements were introduced into the Royal Mint, at Tower Hill,—which was constructed in 1810, under the direction of Messrs. Boulton and Watt, who furnished the steam-engines and the coining machinery. The rolling machinery by Rennie, and the equalizing machinery of Barton, constructed by Maudslay, complete this magnificent establishment. At St. Petersburg, Copenhagen, Calcutta, and Bombay, Messrs. Boulton and Watt erected similar establishments, with

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rolling-mills by Rennie, at the two latter places.

The whole of the above ingenious and valuable inventions, except power-weaving, had been fully carried out and brought into successful practice before the end of the last century. The brilliant results which were obtained from these inventions excited, in an intense degree, the skill and ingenuity of a host of able mechanicians in the various departments above mentioned. The most minute operations were reduced to system by the use of machines, and the high profits derived from manufacturing by machinery, while the prices of the articles continued the same as those formerly produced by manual labour, occasioned a readiness before unknown to adopt all new machines, as well as to extend and improve them.

The general introduction of self-acting machines induced the construction of more extensive mills of all kinds, and rendered necessary the use of more powerful and better regulated prime movers. Water-wheels were employed as the moving power at the early establishments of Cromford, Belper, Matlock, Bakewell, Lanark, Cattran, Deanstone, &c.; and when the governor was afterwards applied to water-wheels by Strutt, at Belper, the motion and power were regulated with a degree of uniformity almost equal to that of the steam-engine, and water was rendered as perfect a moving power as its nature admitted of. Rennie, it is believed, first applied the descending shuttle, by which the flow of water is regulated over its upper edge, so as to obtain the full benefit of the fall, instead of passing under the shuttle as formerly, whereby some of the fall is lost. He improved the construction of the wheel, increased the width and diminished the depth of the buckets, at the same time augmenting the velocity of the periphery from 3 feet to 5 feet per second. By these means nearly 75 per cent. of the power was realized. Strutt's improvements in water-wheels, executed by Hewes, consist in making them with slender iron arms and oblique tie-rods, with segments of teeth on the circumference of the wheel, turning pinions with nearly the same velocity as cranks of steam-engines, and rendering them almost equally applicable. In this department Donkin and Fairbairn have also taken a conspicuous part.

The turbine, or a modification of the horizontal water-wheel, by Fourneyron, has latterly been introduced into this country from France, with, it is said, considerable success. The governor had been applied to windmills by Hooper, in 1789, and soon after Watt adapted it to his rotative steam-engine, which was thereby rendered applicable for turning mills, and its superiority to water, and every other power then known, became manifest. The uniformity and certainty of the movement, its capability of extension to any amount, its applicability to any situation, rendered its adoption almost universal, and extended the sphere of manufacturing operations from the weaver's cottage and the banks of the lonely stream, to large populous towns, such as Manchester, Leeds, Macclesfield, and other places, wherever circumstances, independent of water, were favourable for their adoption.

The concentration of manufacturing operations, caused a number of small machines to be substituted for those formerly impelled by hand in workmen's cottages, and brought together in large buildings adapted for that purpose, and worked by one great moving power, and so combined with each other and the building, as to render a spinning mill, with its water-wheel or steam-engine, and all its accessories, one vast and complicated machine. A new school for mechanics was thus formed, in which far greater power than had ever before been applied to machinery, was to be distributed amongst a number of delicate machines of the greatest variety of form and complexity, with some parts minute, like clock-work, requiring every gradation of force to drive them, and corresponding strength in some for resisting the largest and others the smallest impulse. A new and extended field of inquiry and observation was thereby produced, which brought forward artists of every description to contribute their aid, as to one common stock of knowledge, for the advancement of the new system of manufacturing, as well for the invention of new machines and processes, as for the multiplication and improvement of those previously invented. The ingenious and valuable labours of the great mechanicians of the last century have been most ably continued by their successors, many of whom are, or have been, our contemporaries, and who with a greatly extended sphere of application, have advanced in the career of improvement with an almost unparalleled rapidity.

Many new machines have been invented, and most of those in daily use have been rendered self-acting or automatical, so as to require no further aid from man than the mere act of presenting the materials to them to be manufactured, directing their progress through the machine, and disposing of them afterwards.

The power-loom, invented by Cartwright, in 1784, was afterwards improved by Austin, Miller, Horrocks, M'Adam, Lane, Bowman, and others, and its employment greatly

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extended. Machinery for making ropes and cordage was invented by Cartwright, Grimshaw, Chapman, and others, and subsequently carried to great perfection by Huddart, as exhibited in the establishment of Turner, Huddart, and Co., at Limehouse. This ingenious and valuable invention consisted in regulating and adapting the lengths of the different yarns or threads composing the rope, so that each might bear an equal strain, which could not be done on the old system. To effect this, a series of bobbins, with the proper lengths of yarns wound upon them, were placed in a frame of a crescent form, and the yarns from these bobbins were conducted through holes in a vertical guiding-plate, having those holes arranged in concentric circles; from thence the yarns passed through a vessel of liquid tar or pitch, and then through a single hole of the required gauge, on to a large reel mounted in an oblong frame, to which a rotatory motion about a horizontal axis, was communicated for twisting all the yarns together into a strand, and also a circular motion of the reel at right angles to that of the frame, for winding the strand upon the reel, as fast as they were wound off the bobbins; a guide was attached which regulated the winding. The whole was worked by one of Watt's steam-engines. By this beautifully-contrived piece of mechanism, the whole of the yarns were twisted into a strand of the required dimensions. The pitch and tar employed was used either cold or warm, and derived the application of warm or cold register cordage accordingly. The cables were formed by a larger machine, combining three of the above-described frames together, each having one of the strands to form the cable wound upon its reel; but the axes of the three frames, instead of being horizontal, as in the first case, were vertical, and all mounted in one large frame, which received a rotatory motion, about a vertical axis of its own, and carrying round the minor frames combined within it in order to twist the three strands together. The several strands were unwound from the reels, in the minor frames, as fast as the three were twisted together into the intended cable, which was drawn upwards between pairs of grooved rollers, disposed above the centre of the main frame, and the cable was conducted away by the same machinery, and coiled up for use. Nothing could be more striking than the spectacle of one of these magnificent machines, resembling a great orrery in motion, pursuing its silent yet resistless course, producing the means of securing at anchor the gigantic vessel of war against the raging tempests of the ocean. This magnificent machinery, after returning a handsome reward to its ingenious inventor, and the enterprising capitalists who erected it, was bought by government, and erected at the Royal Arsenal, Deptford. Chapman's rope machinery, and Curr's for making flat ropes, chiefly used for mines, as well as a new machine, lately introduced at Portsmouth from France, said to be the invention of Hubert, are worthy of notice.

Dyer's machines for making cards for cotton and wool; and others for cutting nails; Wilkinson's, for making weavers' reeds; the self-acting mules of Eaton, Roberts, Smith, and others; those for weaving bobbin-net lace, by Heathcoat, Morley, and others; Holdsworth's, Dyer's, and other improved machines for preparing cotton rovings; Marshall's, P. Fairbairn's, and other machines for flax; are all ingenious and important inventions of self-acting machinery, well calculated to improve, expedite, and economise the manufacture of the various articles for which they were intended. Amongst the same class may be mentioned the curious inventions and improvements of Didot, Donkin, Fourdrinier, Dickinson, Crompton, Towgood, Ibotson, Kœnig, Nicholson, Tilloch, Congreve, Stanhope, Cowper, Applegarth, Spottiswoode, and others, for making and drying paper, and printing by steam; Oldham's various contrivances for printing bank-notes at the banks of England and Ireland; Lowry's, Maudslay's, Perkins', and other machines for engraving on metal plates; Holingdrake's method of casting copper under pressure, for engraving; Brunel's block machinery, executed by Maudslay, at Portsmouth, by which every operation is performed, from the sawing of the rough piece of wood until the perfect completion of the block for naval purposes; his saw-mills at Chatham and Woolwich; Bramah's planing-machine at Woolwich; Wilkinson's machine for boring large cylinders, are splendid specimens of machinery: neither must we omit Watt's simple operation of making small leaden shot, by pouring melted lead through holes in a cullender at the top of a lofty tower, when they assume a spherical form in cooling, as they fall through the air, and finally into cold water below. Leaden bullets are compressed into a spherical form with great solidity by self-acting machines by Napier. The manufacture of crown and plate glass has been improved, and promises great extension; in this latter branch, Green, Pellatt, Chance, and others, are making great progress. The universal and widely-extended application of machinery to every manufacturing operation, rendered a corresponding activity and means of sup-

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plying the increased demand for it absolutely necessary; and additional means of making machines have been invented. Self-acting turning lathes, with slide rests, planing machines for metals, also for screwing bolts and nuts, were introduced by Fox; mortising machines, similar to those of Brunel, were adapted by Sharpe and Roberts for metals, and shaping machines by Penn; these have been improved by Whitworth, Nasmyth and others, by whom also new ones have been invented. The former has introduced an ingenious adaptation of machinery for sweeping roads and streets, and which, from its efficiency, is coming into general use: and to the latter we are indebted for the steam hammer and steam pile-driving machine, which serve materially to economise and facilitate these operations. Rennie, as far back as 1801, had applied steam for driving the piles of the coffer-dam for the London Docks; it has since been applied at Sunderland for a similar purpose, and he proposed it for working the cranes there as well as at the West India Docks; but it was not adopted. Otis' American machines for excavation have been tried, but are not as yet much employed. The invention and application of these various new and ingenious contrivances furnished the means of executing machinery with a degree of economy and accuracy which, without them, could never have been attempted. With the advancement of machinery, the art of founding in iron, which commenced at Carron, soon became an indispensable part of machine making. In this department Boulton and Watt took the lead, in consequence of the demands for their steam-engine, and made great improvements in it, which were afterwards followed by Maudslay (particularly) and by others. The working in metal towards the commencement of this century thus became so much facilitated, that it was generally adopted, instead of wood, for the framing and moving parts of machinery; and castings in iron, of excellent quality, could be obtained in any number exactly like each other, so as to be fitted together with great facility. In the progress of modern improvements, wrought or forged iron came into more general use, and was substituted for cast-iron in many cases—such as for railways, suspension bridges, tie-beams, and roofs for buildings; various parts of steam-engines, mill-work, and machines of different kinds, and in some instances steel has been adopted. As the improvement in machinery for manufacturing advanced, so did the arrangement, convenience, economy, and construction of the buildings in which it was contained; fire-proof arching for floors, with cast-iron beams, wrought-iron ties, cast-iron columns, and wrought and cast-iron framing for roofs, window-frames, and every other part where the introduction of metal was practicable; in these improvements, Strutt, Rennie, and others took a leading part. Apparatus for warming buildings by heated air was adopted by Strutt and Silvester; and by steam, which had been employed by Smeaton, for drying gunpowder, was generally introduced by Snodgrass in 1798, and improved by Houldsworth and Creighton. This system has been more recently succeeded by that of heating the air by contact with pipes or vessels, in which a circulation is kept up, as practised by Price, Manby, Perkins, Haden, and others. These and many other improvements have been introduced, and combined in the most scientific manner in the great cotton-mills of Messrs. Phillips and Lee, M'Connell and Kennedy, Houldsworth, Birley, and numerous others at Manchester; Messrs. Horrocks' at Preston, Strutt's at Belper, the flax-mills of Marshall, and the woollen-mills of Messrs. Gott, at Leeds, and of Wilkins near Bath, the silk-mills of Grote at Yarmouth, the lace-manufactories of Heathcoat at Tiverton, Boden and Morley at Derby, and Fisher at Nottingham; Cartwright and Warner's steam-power stocking-weaving manufactory at Loughborough, and many other magnificent establishments all over the kingdom. The workshops of Fox, Nasmyth, Sharpe, Roberts, Whitworth, and others, for making tools; the steam-engine and machine manufactories of Boulton and Watt, Fawcett, Bury, the Butterly Company, Stephenson, Hawthorn, Donkin, Hall, Fairbairn, Hick, Napier, Miller and Ravenhill, Maudslay and Field, Penn, Rennie, Seaward, &c., are a few of the vast establishments which abound, and which fill us with astonishment at the immense productive powers of this country; we are at a loss which to admire most, the genius and skill which has designed them, the energy and talent which directs them, or the capital which has brought them into operation. For accounts of many of the numerous branches of the immense manufacturing industry of Great Britain, we are indebted to Farey's articles in the Cyclopædia of Rees, the Encyclopædia of Brewster, and the Supplement to the Encyclopædia Britannica, also to those of Babbage and Barlow in the Encyclopædia Metropolitana, and likewise to Dr. Ure.

The improvement and extension of manufactures required a constant, active, and steady communication between the several districts where they were carried on, and soon produced a corresponding improvement in the roads, railways, canals, rivers, and

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ports. The cost of every article was reduced to the greatest nicety, and economy was carried to the minutest degree; being so intimately connected together, the extension of the one kept pace with the other. The same may be said of the arts of mining and metallurgy, by which coals for fuel and metals for manufactures are furnished to the different establishments.

SCREW v. PADDLE.

Sir,—Captain Halsted, or rather his *protogé*, the screw, appears to have some very serious and persevering antagonists; but as all parties, the gallant captain included, start upon the plea of endeavouring to establish "truth" and "justice," and, no doubt, this is their object, and personal triumphs, therefore, quite out of consideration, it consequently appears strange that a purely scientific, or rather mechanical question, cannot be discussed without that apparent soreness so much displayed in the controversy; and it is much to be regretted that more good humour is not shown, especially when it would spare much of your valuable space, and save the time of your readers, now wasted in wading through matter much better omitted, to get at the data, and facts mixed up with it. So much chaff to be sifted to find the corn!

As an onlooker, allow me to suggest to the paddle advocates, to remember that the screw is now only in its infancy, when compared with their favourite; and Captain Halsted, I recommend not to claim too much for the screw, as to *present* performances. No one will deny, I think, that the screw has some undoubted advantages over its competitor, particularly for war-steamers; such as,

First, The submersion of the screw out of harm's way in action.

Second, The facility it affords for placing the engines and boilers in comparative safety, under the same circumstances.

Third, Presenting a clear broadside and flush deck for the battery.

Fourth, Removing the lumbering paddle-boxes and top hamper, which hold almost as much wind when head to it, as a main-top-sail aback.

Fifth, Its equable and regular strain whatever may be the rolling of the vessel.

These are *practical* advantages that Captain Halsted may certainly claim; and in *theory,* I cannot see why the screw should not have the advantage as a propeller. We know a screw is one of our greatest mechanical powers on shore; and I think the lever, *as applied by the paddle,* is not so; I therefore hope ere long to see such improvements made in the marine screw, as shall put it in the same commanding position as its prototype on shore.

I confess to have had no experience in steamers of any sort, but probably a screw of larger circumference than now generally fitted would answer better than any yet tried, both as to speed and *handling* the vessel in starting a-head, or backing astern, or stopping; but we can scarcely expect the screw to have the advantage over the paddle in *everything,* until much more time and attention has been paid to it. Speed is certainly one principal point to be considered, but not the only one by many. Let us hope that your correspondents, including the gallant Captain and his opponents, will turn their abilities and experience, which are evidently first-rate, to the improvement of our steam-vessels in general, rather than squabling about the comparative merits, or rather demerits, of particular ones.

I am, Sir, yours, &c.,

T. W.

Esher, Surrey.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

INTRODUCTION.

Specifications of Inventions, inrolled in Chancery pursuant to the several statutes in that case made and provided, may be inrolled at the pleasure of the party, either upon the close rolls made up heretofore by the six clerks, and now by the clerks of the records and writs, and which are transmitted at stated periods to the Rolls Chapel; or upon the specification and surrender rolls at the Rolls Chapel; or upon the specification rolls at the Petty Bag-office. Of those specifications which come into the Rolls Chapel, whether upon the close rolls or upon the specification rolls, there is an office calendar; but it is brief, and does not sufficiently disclose the nature of the

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inventions secured by the patent. These specifications are in themselves matters of considerable curiosity: they contain important materials for the history of inventions, and show the progress of mechanical science. They equally possess great practical utility by affording suggestions to persons engaged in scientific or mechanical pursuits, and are therefore much searched. In order to render their valuable contents more known, new calendars are now in progress, under my direction, which disclose much more fully than the office calendar the nature of the inventions and the objects for which the patents were granted; and a portion of such new calendar, from the period when the enrolments of such specifications begin, is herewith submitted to Your Majesty.—*Sir Francis Palgrave's Sixth Report.*

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

William Hinton, of Vauxhall, Surrey, gentleman; specification for discoveries and improvements in extracting, curing, and calcining the lixiviate salts of ashes of wood or other vegetables, and obtaining a potash, pearl ash, or fixed neutral salt of equal efficacy as that imported. July 21, 1726; July 29, 12 Geo. 1, 1726.

Benjamin Lund, of the city of Bristol, merchant, and Francis Hawksbee, of the city of London, gentleman; specification for a more advantageous manufacture of copper ore through the intermediate operations, till it be brought into fine copper, and from thence into brass, to be cast (formed) into various utensils, by a new way of calcining, melting, and running copper ores, and making brass; requiring also a peculiarly contrived furnace, whereby the sulphur in those ores is sooner destroyed, and the silver extracted without destroying the copper, and also a new method of mixing the copper, calamy, and charcoal together, and making brass therewith without pots. Feb. 3, 1 Geo. 2; Feb. 17, 1727.

John Payne, of Bridgewater, Somerset; specification for a new engine to be moved by the pressure of the air into any building where large fires are used, as glass houses, &c., whereby the air within being rarefied occasions a pressure of air from without, through an avenue into the building of sufficient force to turn a wheel that will grind corn, move hammers, raise water, &c.; also for a more advantageous method of applying the heat of fire, by extending the heat of one and the same fire to two or more furnaces, coppers, boilers, stills, or other vessels for melting metals, and also for drying malt, brewing, distilling, and refining salt, or making the same: also for a new method of making and placing the pans so that the same quantity of salt may be made more cheaply than by the common methods; also for the further application of the fire of furnaces to vitrifying the dross of metals so as to mould the same like bricks or tiles, or other forms, for convenience and ornament; likewise for a new method whereby pig iron being put into fusion with other ingredients may be brought into a state of malleability. Nov. 21, 2 Geo. 2; Dec. 19, 1728.

John Allen, doctor in physic; specification for a new method of saving fuel in heating water and other liquids, by making the fire in the middle of the boilers of engines for raising water by fire, also for distilling, &c. Also for the application of certain powers to give motion to engines for various purposes, such as propelling a ship in a calm by forcing water through the stern of the ship at a convenient distance under the surface of the water into the sea, by engines placed within the ship for that purpose, and for draining mines, &c., which engines are set in motion by exploding gunpowder *in clauso*, or in a confined place. Also for a new method of drying malt, by the intervention of a stratum of boiling water between the fire and the malt. Aug. 7, 3 Geo. 2; Sept 1, 1729.

Walter Churchman, of the city of Bristol; specification for an invention for the expeditious, fine, and clean making of chocolate by an engine. Jan. 24, 3 Geo. 2; Feb. 25, 1729.

Disney Stanyforth, of Furbeck, York, Esq., and Joseph Foliambe, of Rotherham, York, yeoman; specification for a new sort of plough, whereby three acres of ground may be ploughed at the same cost and in the same space of time as two acres with the plough now in use. Sep. 21, 4 Geo. 2; Nov. 7, 1730.

Robert Barlow, of Reading, Berks, millwright; specification for a new machine for cleaning wheat, to be wrought by water, wind, horses, &c., together with the corn mill, and is contrived to take away the stains, smut bags, and other trumpery. March 22, 4 Geo. 2; June 16, 1731.

William Bucknall, gentleman, of the parish of St. Mary-le-Bow, Middlesex; specification for a new mathematical instrument in two parts, for the improvement of astronomy and navigation; the one part being an instrument for ascertaining the meridian,

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and the other part being a stool on a conical pin for preserving in a horizontal position the person making observations on board ship with the preceding instrument. April 30, 4 Geo. 2; May 18, 1731.

Walter Churchman, of Bristol; specification for an engine to be worked by the united powers of weight and draught for raising water, draining low lands and pits, grinding, stamping, &c. March 21, 6 Geo. 2; May 7, 1733.

Robert King, of the city of Peterborough, ironfounder; specification for a machine for the scowering the inside of cast-iron boxes for all manner of carriages [worked by horse power.] A parchment schedule of drawings is attached. Oct. 1, 8 Geo. 2; Nov. 2, 1734.

Kingsmill Eyre, Esq.; specification for making raw iron from the ore in air furnaces with pit coal. March 20, 9 Geo. 2; June 8, 9 Geo. 2, 1736.

John Payne, of London, merchant; specification for a new and more advantageous method of expanding fluids, which, being conveyed into a proper ignified vessel or vessels contrived for that purpose, are immediately rarefied into elastic impelling force sufficient to give motion to hydraulo-pneumatical and other engines and machines for raising water and other uses, and also in brewing and distilling by a new form or make of the boiler, &c. Nov. 15, 10 Geo. 2; Jan. 13, 1736.

Jane Vanef, of the parish of St. Anne, Westminster, widow, hoop-petticoat maker; specification for a new invented hoop-petticoat, with foldings, whalebone and metal joints, and strings for contracting the compass of a petticoat from four yards in circumference to two yards, and thereby causing less inconvenience to the wearer in churches, assemblies, coaches, and chairs. Dec. 15, 11 Geo. 2; Feb. 7, 1737.

Isaac Wilkinson, of the parish of Coulton, Lancashire; specification for a new sort of cast metallic boxes for the smoothing of linen. July 8, 12 Geo. 2; Aug. 10, 1738.

Adrianus Vanden Bommenaer, of Low Layton, Essex, manufacturer; specification for a machine for twining and twisting of yarn to thread, for the making of superfine lace and cambric, and proper for all other uses such as is practised in foreign parts: [to be set in motion by water or hand power.] June 27, last past; Sept. 20, 1738.

Ignatius Couran, of London, merchant; specification for a new invention of making carpeting, called French Carpets, or Moccadoes, enrolled pursuant to patent granted to the said Ignatius Couran, John Barford, of the borough of Wilton, Wilts, upholder, and William Moody, of the same borough, clothier. A parchment schedule of drawings is attached. July 18, 15 Geo. 2; Oct. 16, 1741.

James Creed, Esq., of East Greenwich, Kent; specification for three different engines or contrivances for cutting sheet lead into any required breadths for making water pipes, and for covering buildings with such lead, or with copper or brass; and also a new pump, engine, or forcer, for raising water with a perpendicular stroke. Sept. 9, last past; Jan. 7, 1741, 15 Geo. 2.

Mary Harris and Henry Burt, executors of Thomas Harris, of Chelsea, Middlesex; specification for a new invention of making saltpetre or nitre [extracted from every kind of salt, brine, animal, vegetable, and mineral matter whatsoever.] Nov. 19, 15 Geo. 2; March 18, 1741.

William Cogan, alderman of Kingston-upon-Hull; specification for pressing oil out of poppy seed, for the use of house painters, and for a new method of cultivating the same. April 10, 15 Geo. 2; April 14, 1742.

Robert Hayward, of the city of Bristol, apothecary; specification for a powder to cure gout and rheumatism. May 13, 15 Geo. 2; July 1, 1742.

Michael Betton, of Wellington, Salop, gentleman; specification for an oil for the cure of rheumatic and scorbutic cases, extracted from the black, pitchy, flinty rock found immediately over coals in coal mines; enrolled pursuant to patent granted to the said Michael Betton and Thomas Betton, of Shrewsbury. Aug. 14, 16 Geo. 2; Aug. 17, 1742.

Daniel Chappell, citizen and merchant tailor of London; specification for printing several sorts or species of woollen manufactures of their several kinds, such as goods made of all wool, goods made of worsted and silk, mohair and silk, and of plain mohair, of their several kinds [with wood blocks, in the same manner as calicoes.] Aug. 7, 16 Geo. 2; Oct. 1, 1742.

John Tuite, of the city of London, goldsmith; specification for an engine to raise water, for draining lands and mines, supplying towns, pumping ships. This engine may be set in motion by man, horse, or water. July 30, 16 Geo. 2; Oct. 5, 1742.

George Lindsay, of the parish of St. Martin-in-the-Fields, Middlesex, watchmaker; specification for a general portable folding microscope, which, with parts for transparent and opaque bodies, conveniences for living creatures, and a stand and reflecting speculum, may be contained in a space of six cubical inches. A parchment schedule of drawings of the instrument is attached. Feb. 7, 16 Geo. 2; May 31, 1743.

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Ambrose Newton, of Kettleness, York, gentleman; specification for a method of making alum out of dross (commonly called settler slam and slam pan slam) of the liquor out of which other alum is made, which hath hitherto been esteemed of no use. April 4, 16 Geo. 2; June 25, 1743.

William Keen, of the city of Coventry, carpenter and joiner; specification enrolled pursuant to patent granted to the said W. Keen and Moses Platt, of the same city, carver, for a machine for printing history, landscapes, fruit, &c., upon silks, cottons, linens, and woollen fabrics. A paper schedule of drawings of the machine is attached. March 10, 16 Geo. 2; July 7, 1743.

Thomas Lowther, gentleman; surrender of the office of one of the four messengers in ordinary at the receipt of the Exchequer, held by patent Nov. 2, 1 Geo. 2. July 20, 17 Geo. 2, 1743.

John Gregory, the elder, of the Parish of St. Giles in the Fields, Middlesex, timber merchant; specification for an engine for draining of fens or marsh lands, to be worked by wind or horses; and the same engine, with a little alteration, will raise ballast out of rivers. A parchment schedule of drawings is attached, whereon is indorsed to the effect that this plan is the one referred to in the condition of a bond, dated Dec. 24, 1743, entered into by the said John Gregory to Lewis Pantin. Jan. 5, 17 Geo. 2; Jan. 16, 1743.

Lewis Pantin, of the parish of St. Anne, Westminster, Middlesex, goldsmith; specification for a machine for raising ballast, mud, &c., from the bottom of rivers; also for driving piles in the water or upon land; worked by horse power. A parchment schedule of drawings of the machines is attached, whereon is indorsed to the effect that this plan is the one referred to in the condition of a bond, dated Dec. 24, 1743, entered into by John Gregory the elder to the said Lewis Pantin. Jan. 21, 17 Geo. 2; March 21, 1743.

Thomas Greenough, of the parish of St. Sepulchre, London, apothecary; specification for a tincture for cleansing and preserving the teeth and curing the tooth-ache. Feb. 9, 17 Geo. 2; May 8, 1744.

Robert Turlington, of London, merchant; specification for a specific balsam, called the Balsam of Life. Jan. 18, 17 Geo. 2, May 10, 1744.

Joseph Collett, of the parish of St. Clements Danes, Middlesex, dealer in medicines; specification for an elixir for the cure of dropsy, jaundice, stone, and gravel. Feb. 17, 17 Geo. 2; May 16, 1744.

Francis Tanner, of the parish of St. George, Bloomsbury, gentleman; specification for a specific pill, which is a local sudorific, sweating one joint or limb only. Jan. 24, 17 Geo. 2; May 12, 1744.

Charles Neville, of Little Gunnerbye, in the parish of Grantham, Lincoln, Esq.; specification for a lime, stucco plaster, morter, cement, and manure of, and from cockle, oyster, and other sea shells, by grinding, pounding or burning the same. June 22, 18 Geo. 2; July 19, 1744.

John Neale, of Leadenhall-street, in the city of London, watchmaker; specification for a new invention of a quadrantal planetarian machine, by which the altitude of any of the planets or fixed stars may be taken; as also all the uses of the orrery answered. A parchment schedule of drawings of the instrument is attached. July 12, 18 Geo. 2; Oct. 27, 1744.

Andrew Reid, merchant, of the city of London; specification for a way to make bay salt in this kingdom by the heat of the sun only, free from mud, and perfectly fit for all the uses to which bay salt is applied, and that too in a degree at least equal to what is imported from France. July 13, 18 Geo. 2; Nov. 10, 1744.

Nicholas Belli and Anthony Gualterini, of London, merchants; specification for the sole raising, planting, and working a vegetable (called Sesamo) extraordinary productive of oil of a sweet taste, fine colour, wholesome, and of great use, but more especially in the manufacturing of wool. Sep. 6, 18 Geo. 2; Nov. 13, 1744.

Francis Jephson, Esq.; surrender of the office of Serjeant at Arms to the Chancellor of Great Britain, held by patent Feb. 10, 2 Geo. 1. Sep. 24, 19 Geo. 2, 1745.

Edward Fairless, of South Shields, Durham, merchant; specification for an invention by furnaces and preparative pans for boiling sea-water to make salt thereof. A plan of the arrangement of the pans is drawn upon the roll. Sep. 17, 19 Geo. 2; Dec. 9, 1745.

Edmund Lee, of Brock Mill, near Wigan, Lancashire; specification for a self-regulating wind machine. A parchment schedule of drawings is attached. Dec. 9, 19 Geo. 2; March 18, 1745.

Diederick Wessell Linden, of Southampton-street, Covent-garden, Middlesex, doctor of physic; specification for a method of making saltpetre out of salt, lime, scorios of iron, stones with iron in them, loom, or green vegetables, or any manner of animal excrements, substances, and bodies in a state of putrefaction. April 1, 19 Geo. 2; June 21, 1746.

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Edmund Neeler, of the parish of Hammersmith, Middlesex, gentleman; specification for a medicinal belt, chemically prepared, to cure most distempers incident to mankind. The teste has been left blank; the date given is that of the acknowledgment. April 1, 19 Geo. 2; June 26, 1746.

Thomas Hawkes, of Wells, Norfolk, land surveyor; specification for a machine to be placed on the axle-trees of wheel carriages, as chairs, chaises, and such like vehicles, &c., if the carriage or wheels overturn, the bodies of them cannot. A paper schedule of drawings is attached. July 26, 20 Geo. 2; Nov. 22, 1746.

Henry Haskins, of Northfleet, Kent, chemist; specification for a new method of extracting a spirit or oil out of tar, and by the same process produce the finest of pitch. Aug. 7, 20 Geo. 2; Dec. 2, 1746.

Isaac Rowe, of the parish of St. Margaret, Westminster, silversmith; specification for a new machine, with pumps not requiring either box or sucker, as in others now in use, which will raise large quantities of water from great depths, and discharge the same through large boxes at great heights or distances out of mines, &c., and is also applicable to working any kind of mills where little or no water is to be had, or in standing pools, or upon dry land, without horse, fire, or wind. A paper schedule of drawings is attached. March 21, 20 Geo. 2; May 8, 1747.

Samuel Lucas, salt proprietor, at Droitwich, Worcester; specification for a new invention for erecting salt pans for the boiling of salt. A paper schedule, being a ground plan for the said erections, is attached. July 27, 21 Geo. 2; Nov. 12, 1747.

Thomas Jackson, of Wellington, Salop, yeoman; specification for a tincture or medicine. Dec. 9, 21 Geo. 2; Jan. 23, 1747.

Thomas Harris, of Fleet-street, London, watchmaker; specification for a machine for raising water extensively beneficial to the public, which, by its wonderful operation, demonstrates a much superior force than any ever yet made use of for draining low and marshy lands, &c., which machine or engine acts from a still body of water continually from an artful power, without loss of time, and also without fire, wind, or horses. A paper schedule of drawings is attached. Nov. 3, 21 Geo. 2; Jan. 29, 1748.

Josias Johannot, late of London, stationer, but now of Paul's Cray, Kent, papermaker; specification for an invention for making cartridge or any other sorts of paper that will not hold any fire. Nov. 3, 21 Geo. 2; Feb. 10, 1747.

Robert James, of the parish of St. James, Westminster, M.D.; specification for a powder and pill, which in a few hours, and a very few doses, most effectually cures acute fevers of all kinds. Nov. 13, 21 Geo. 2; Feb. 11, 1747.

Daniel Bourn, of the Borough of Leominster, Hereford, dealer in wool and cotton; specification of a machine for carding wool and cotton either by hand or water. A paper schedule of drawings is attached. The teste has been left partly blank, as shown below, but the acknowledgment is dated May 14. Jan. 20, 21 Geo. 2; — May, 1748.

Onesiphorus Paul, of Woodchester, Gloucester, clothier; specification for a method of preparing cloths intended to be dyed scarlet, so as more effectually to ground the said colours and preserve their beauty, and also of taking out all such lints, spills, and other things which will not receive the dye, so as not to leave any hole or blemish whatsoever therein after they are dyed and finished. March 19, 21 Geo. 2; July 11, 1748.

Daniel Bridges, of the town and county of Kingston-upon-Hull, apothecary; specification for a new method to refine, purify, and meliorate an oil extracted from rape seed, commonly called rape oil. April 16, 21 Geo. 2; Aug. 9, 1748.

Thomas Stephens, of the parish of St. James, Westminster, Middlesex, ironmonger; specification, pursuant to patent, granted to one Moses Hadley, of the parish of St. Martin-in-the-Fields, Middlesex, engineer, and the said Thomas Stephens, for a new double concave boiler, with a flanch for raising steam by fire to work atmosphere engines for raising water, and other purposes, and by means whereof such engines may be worked at much less expense than they have been heretofore. A section of the boiler, and the plan of setting the same, is drawn upon the roll. July 12, last past; Aug. 27, 22 Geo. 2, 1748.

Walter Baker, of Helmet-court, in the Strand, Middlesex, chemist; specification for his new chemical preparation and medicine, which he hath styled Schwauberg's Liquid Shell. July 12, 22 Geo. 2; Oct. 10, 1748.

Joshua Wheeler, mercer, of the city of Worcester; specification for a new invention to prepare woollen cloth and hats, so as to render them capable of keeping out much more than a day's or week's rain, without impairing either the beauty or strength of the cloth or hats. June 27, last past; Aug. 26, 1748.

George Spence, of the parish of St. Olave, Southwark, dyer, Charles Dolby, of Lothbury, London, warehouseman, and John

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Christopher Wegnelin, of Throgmorton-street, London, merchant; specification for the art or mystery of dying green and blue Saxon colours in woollen, worsted, and silk goods, which have hitherto been sent abroad to be dyed. (The secret whereof was purchased from a foreigner.) Aug. 8, 22 Geo. 2; Dec. 1, 1748.

Lewis Paul, of Birmingham, Warwick, gentleman; specification of a machine for carding of wool and cotton, &c. Aug. 30, 22 Geo. 2; Dec. 16, 1748.

Five paper schedules of drawings are attached to m. 28, containing plans, and a minute description of the machine.

Thomas Walford, of Manchester, Lancashire, chapman; specification for an engine or machine for the laying or intermixing of threads, cords, or thongs of different kinds, commonly called platting. A parchment schedule of drawings is attached. Nov. 18, 22 Geo. 2; March 15, 1748.

Thomas Ribright, of the parish of St. Laurence Mildred, London, optician; specification for a new method of making small perspective glasses with mathematical and other instruments and twees, in one and the same case, both with and without microscopes or magnifying glasses therei , in a very portable, neat, and ornamental manner. A paper schedule of drawings is attached. Feb. 7, 22 Geo. 2; May 30, 1749.

Richard Langworthy, of South Brent, Devon, surgeon; specification for a machine which is to be turned by the winds only, and of such contrivance and purchase that it will draw and extract with great ease any weight of water, metal, &c., from pits, quarries, &c., and will also be very useful in windmills, stamping mills, and on shipboard. A paper schedule of drawings is attached. May 9, 22 Geo. 2; Aug. 19, 1749.

John White, of Twickenham, Middlesex, gentleman; specification pursuant to patent granted to Joshua Ward, Esq., of the parish of St. Martin-in-the-Fields, Westminster, and the said John White, for a certain acid spirit of sulphur, with sulphur and saltpetre, which in all things answers and in some excels oil or spirit of vitriol. June 23, 23 Geo. 2; Oct. 12, 1749.

Samuel Palmer, of the parish of St. Martin-in-the-Fields, Middlesex, surgeon; specification for a new kind of horsebits, of various constructions. A paper schedule of drawings is attached to m. 37, containing letters of reference and a very full description. June 29, 23 Geo. 2; Oct. 21, 1749.

Daniel Jewers, of St. Edmund's Bury, Suffolk; specification pursuant to patent granted to the said Daniel Jewers and one William Lodge, of the same place, gentleman; for a new method of making pearl-ashes, as good as that made abroad, and in greater perfection than that made in Prussia. July, 1, 23 Geo. 2; Oct. 14, 1749.

Thomas Smith, leather-seller and citizen of London, now dwelling in the parish of Christchurch, Spitalfields; specification for a medicinal snuff, for the cure of capital disorders of the hypochondriac and melancholy kind, as also of imposthumations, agues in the head, ejection of polypuses, &c. Dec. 6, 23 Geo 2; Jan. 19, 1749.

Thomas Frye, of the parish of West Ham, Essex, painter; specification for a new method of making a certain ware which is not inferior in beauty and fineness, and is rather superior in strength than the earthenware which is brought from the East Indies, and is commonly known by the name of China, Japan, or Porcelain ware. Nov. 17, 23 Geo. 2; March 17, 1749.

John Batcheler, of the Old Artillery Ground, in the liberty of the Tower of London, weaver; specification for a new invention whereby brocades and tissues in gold, silver and silk, gold or silver and silk, or silk only, are greatly improved; which will enable the English not only to vie with, but to excel the French, or any other foreign manufacturers, and which has been brought to perfection by the patentee and one Jabez Stephenson, of St. Mathew, Bethnal Green, Middlesex, weaver, whose interest therein the patentee hath purchased. Feb. 6, 23 Geo. 2; May 30, 1750.

Michael Meinzies, Esq.; specification for a machine for the carrying coals from the coal walls where they are dug to the bottom of the pit or shaft, and from the mouth of the shaft to the heaps at some distance therefrom, and in some cases to the places where they are put on board ship, without the assistance of horses, and for a new method of moving a known machine for drawing the coals from the bottom of the shaft to the top thereof. Feb. 9, last past; June 5, 23 Geo. 2, 1750.

Sir James Creed, of Greenwich, Kent, knight; specification for a method of making white lead, and also of casting lead which is to be used for milling, for the covering of churches, &c. Dec. 13, last past; June 12, 1750.

John Thompson, of Uxbridge, Middlesex, watchmaker; specification for a chair or carriage for one person to travel in, with one wheel, and harness for the horse to draw the same, different from anything hitherto invented, for travelling in narrow, stony, or rocky roads, and over ruts, with safety and ease to the rider and horse, and at the rate of eight or ten miles an hour. April 6, 1750; July 30, 1750.

(*To be continued.*)

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LIST OF ENGLISH PATENTS GRANTED BETWEEN JAN. 15, AND JAN. 21, 1847.

Henry Grafton, of Holborn-hill, London, engineer, for improvements in railway wheels and apparatus connected with railway carriages. Jan. 16; six months.

Frederick Lesnard, of Chester-street, Kennington-lane, Surrey, engineer, for improvements in obtaining motive power. Jan. 16; six months.

John M'Intosh, of London, gentleman, for improvements in rotatory engines, and in moving carriages up inclines, and in propelling vessels. Jan. 19; six months.

John Read, of Regent Circus, Middlesex, mechanist, for improvements in certain implements for the cultivation of land. Jan. 19; six months.

Edward Vickers, of Sheffield, York, mechanist, for improvements in machinery for cutting files. (Being a communication.) Jan. 19; six months.

Towers Shears, of Bankside, Southwark, for improvements in treating zinc ores for the purpose of producing zinc ingots, which improvements are applicable to the production of other ores and metals. Jan. 19.

Thomas Deakin, of Kings Norton, Worcester, engineer, for improvements in the construction and arrangement of machinery to be used in cutting, stamping, and pressing. Jan. 21; six months.

Thomas Onions, of Calais, France, engineer, for improvements in rotatory steam-engines. Jan. 21; six months.

George Beadon, of Taunton, Somerset, commander in the navy, and Andrew Smith, of Princes-street, Leicester-square, Middlesex, engineer, for improvements in warping or hauling vessels, which improvements are also applicable to moving other bodies. Jan. 21; six months.

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CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W.C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1225.] SATURDAY, JANUARY 30, 1847. [Price 3d.

Edited by J. C. Robertson, 166, Fleet-street.

OSBORN'S STEAM PLOUGH.

Fig. 3.

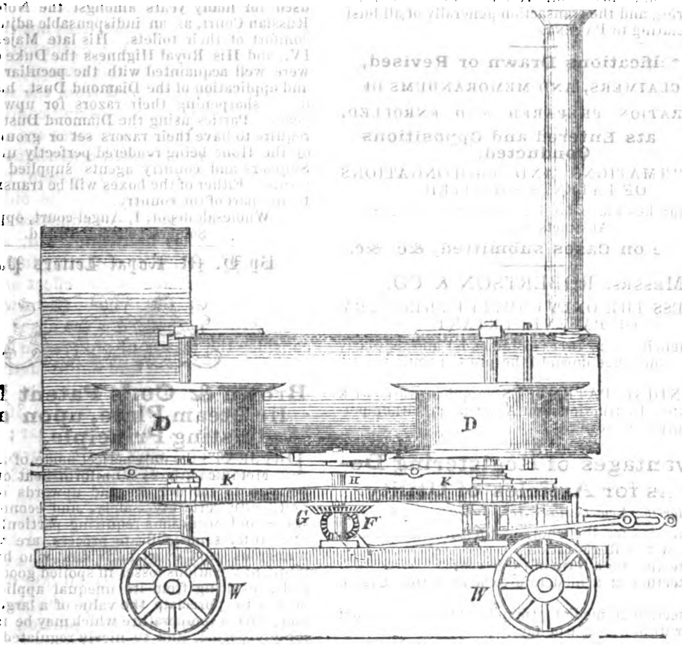
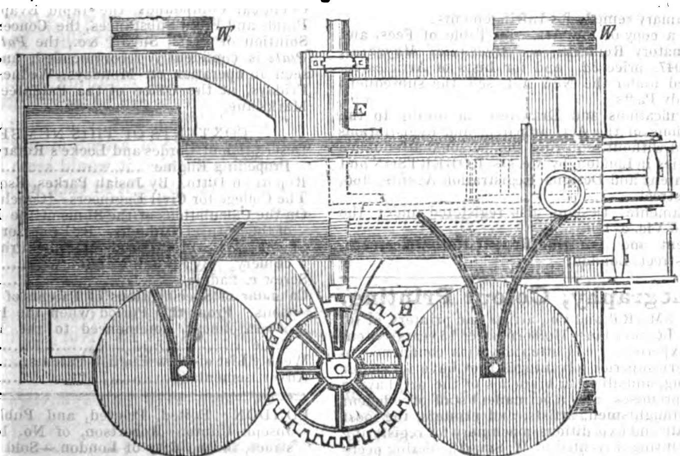


Fig. 4.



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MR. OSBORN'S PATENT SYSTEM OF STEAM PLOUGHING.

[Patent dated July 23, 1846. Patentee, John Tulloh Osborne, Esq., of Demerara; Specification enrolled January 23, 1847.]

The practicability of applying steam power to the plough has formed a problem of some thirty or forty years standing, and has engaged the attention of many ingenious men; but to this day it remains unsolved—ploughing by steam is practised nowhere. Yet, to assume that the thing is impossible, would be to admit a limitation to the powers of steam and the resources of mechanical art, strangely at variance with the all-subduing character of their past triumphs. No—it cannot be that the thing is impossible; it can only be that the day of its success has been deferred.

The same mighty power that has bid defiance to the winds and waves, cannot be destined to be for ever set at nought by either turf or clod. As it has ploughed the seas to their farthest bounds, so will it yet ere long very surely plough the land, throughout its length and breadth —over valley and plain—up to the highest hill-top.

That there would be a real and great gain to the country from the substitution of steam for horse power in ploughing, is capable of easy demonstration. But perhaps we cannot do better than quote what has been said on this head, by the author of the invention we are about to bring under the notice of our readers, in a paper lately addressed by him to the council of the Highland Society:

"At this moment, when a scarcity of food is spreading dismay, and actual famine is abroad in many places, it may not be thought an impertinent inquiry, What are the most efficient and cheapest modes of tilling the soil? or, whether there has yet been applied that amount of skill which the advanced state of science has introduced in the sister arts?

"It will, I apprehend, be found that the art of tillage has not kept pace, from whatever cause it may have arisen, with other branches of manufactures produced from raw materials, the earth being of all raw materials that which should claim the deepest consideration in its mode of treatment, as affecting the interests of mankind most nearly.

"As in most of the arts of life we find there have been progressive steps, so, in the art of cultivation, we find the circumstances are parallel,—the first step being limited to human labour, the second, that of animal power; but the third, that of mechanic power, being wanting to complete the parallel.

"The circumstances under which steam power appears applicable are those in which, from the inefficiency of the present agents, land, cultivated by horse-labour, or exclusively by human-labour, does not remunerate the occupiers; and the conditions,—a surface free from rocks and stumps, such as are met on lands reclaimed from the sea, rivers, lakes, and fens, meadows and commons, and generally where the inclosures are sufficiently large to admit extended operations.

"In offering any new system, it is requisite to prove it better than the old:—*First*, The fact will generally be admitted that where steam power has been employed, and where there are facilities for obtaining fuel, it supersedes all other agents for effect and cheapness. *Second*, But in comparison with horse-labour this is especially the case; for if we consider the period of productive labour, set against that of rest and unproductive labour, most startling results will be exhibited. Thus, horses are fed and tended 365 days of 24 hours, or 8760 hours a year; but they work only 300 days of 8* hours, or 2400 hours a year. 8760 − 2400 = 6360 hours unproductive.

"Assuming M'Culloch's numbers, there are about 1,200,000 agricultural horses employed in Great Britain, which, at 25*l.* per head for maintenance, is 30,000,000*l.* sterling per annum paid by the agricultural body for horse-keep, the portion of which unproductive will be found to be 21,785,306*l.*, or, as 8760 hours : 30,000,000*l.* : : 6360 hours : 21,785,306*l.* Here, then, is one item of the farmers' stock, on which they sustain a palpable loss of 21,785,306*l.* per annum, expended for the production of manure! Is it not, then, worth inquiring whether other less costly agents can be substituted?

"*Third*, The economy of time does not claim that degree of attention on the part of agriculturists which it would seem to merit. The hours of daylight in each month are as follows:

	hrs. m.		hrs. m.
January	230·46	July ..	497·9
February	285·54	August	449·37
March ..	366·46	Sept...	377·49
April ..	405·6	October	328·43
May....	485·15	Nov...	260·50
June ..	494·19	Dec...	235·42

Total 4419·21.

"Of these 4419 hours' daylight, horse-

* I assume eight hours as a mean throughout the year.

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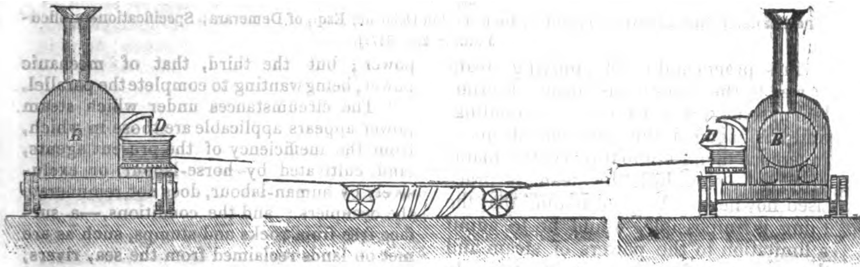
Fig. 1.



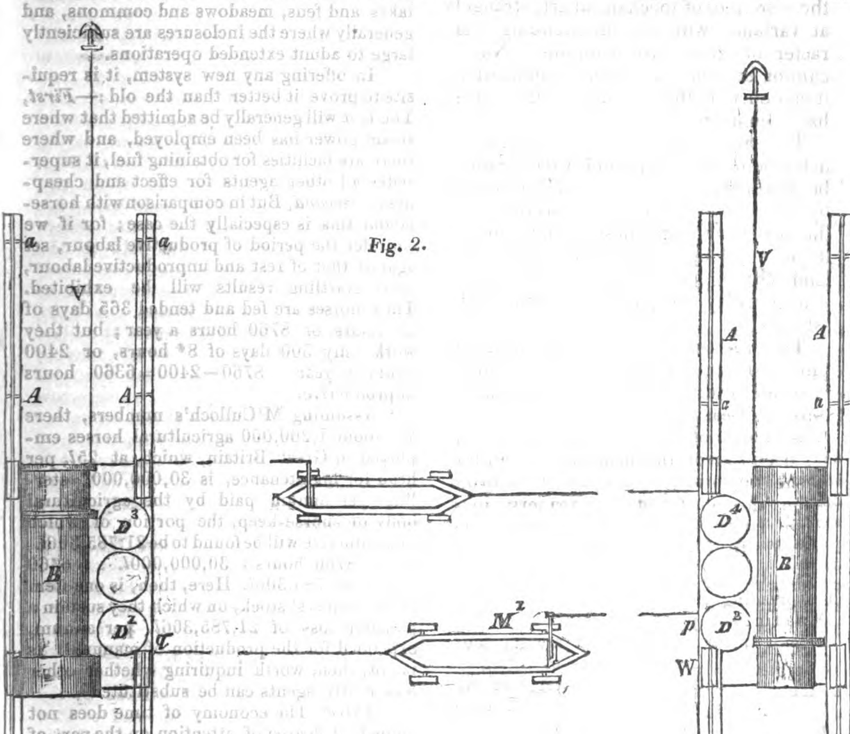


Fig. 2.

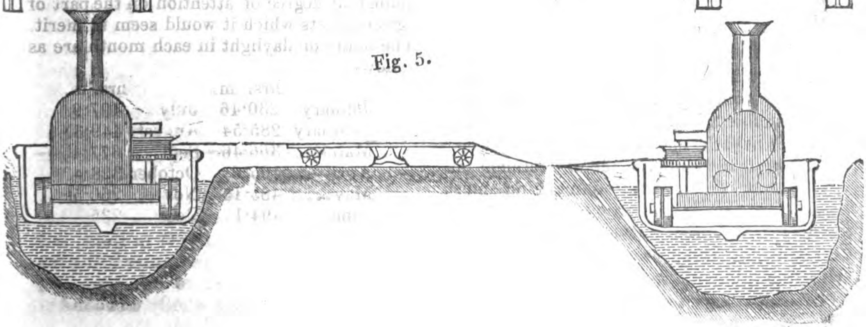


Fig. 5.

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labour is only available for 2400 hours, and human-labour the farmer cannot afford to employ as a substitute. In the long days of summer, spring, and autumn, he has not often sufficient animal power to occupy the time; but in winter, three-fourths of that period he is feeding stock, producing no return but manure. These are insuperable difficulties attending the employment of vital power; but mechanical power puts forth its energy when called for, — it can be regulated, and, at pleasure, stopped.

"If it is desired to occupy the entire hours of daylight—to extend the field of operations—to work up more raw material —the energy of the animal ceases after a time, but not so that of the machine. The longest hours of summer may be advantageously employed.

"The capacity of a pair of steam-engines is equal to 1000 acres of land.

"Were the whole period of daylight industriously employed in the most effective manner—that is, by the employment of machinery — the demand for human labour would be augmented in the exact ratio of the increased time, multiplied by the augmented force of machinery. And this is demonstrated in the power manufactories, where, since the employment of machinery driven by steam, the employment of human labour has increased a hundred fold.

"In extending the field of operations and augmenting the demand for human labour, production would augment with accelerated pace. We might then expect to see the supplies of the necessaries of life in profusion, and to hear no longer the agriculturist exclaiming against the ill success of his speculations, and the oppressiveness of the burdens on land, the weight of the poor's rates, &c.

"Then, in short, we might fairly expect to see agriculture assuming that elevated rank in the sciences and industrial pursuits which, from its immense importance to the welfare of the country, it ought to fill."

The plan of steam ploughing proposed by the author of these sensible and striking observations, seems chiefly distinguishable from those which have preceded it in the employment of two engines and two ploughs for each course of ploughing, (instead of one of each;) each engine being fitted with two drums, and ropes or chains, which cause a simultaneous and reciprocating progression of the two ploughs in opposite directions. The following details we extract from Mr. Osborne's specification:

Firstly. To till, by means of steam or other power, an open field or piece of land, not intersected by roads, or canals, or wide ditches, I make use of two locomotive engines, similar to those used on railways, except that the power of the pistons is differently applied. I place them on the land to be tilled, at distances of from 100 to 200 yards apart, and exactly opposite the one to the other. I cause them to traverse the land on temporary rails, laid for the purpose in parallel lines, at right angles to the direction in which the land is to be tilled, that is to say, in which the furrows are to run; and I employ the pistons of each engine to produce, by means of intermediate gearing, a continuous revolution of two drums, placed on the near side of each engine, or that side which faces the opposite engine, and on the same framework as the engine, which drums have attached to them chains or ropes, by means of which two ploughs, or other tilling machines, are simultaneously drawn in opposite directions from one side of the field to the other. Fig. 1 exhibits a transverse elevation, and fig. 2 a plan of a combination of arrangements of this description. A A are the temporary rails, which consist of hollow circular tubes of iron, or other suitable metal, of from $1\frac{1}{2}$ to 2 inches diameter, and of from 12 to 15 feet in length, which screw endwise into one another, and rest on movable chairs, *a a*, which are supported by movable wooden planks or sleepers, *b b*. B B are the engines, an elevation and plan of one of which are given separately, on an enlarged scale, in figs. 3 and 4. The bearing-wheels, W W, are made with broad flat tires, having semicircular grooves in the centre, of the same diameter as the circular tubular rails, so that the engine may be moved or drawn on common roads to the place of operations, and then shifted on to the tubular rails. D^1, D^2, D^3, D^4 are the drums; E is a crank shaft, worked by the pistons P P, which has on one end of it a vertical pinion, F, which takes into a horizontal bevil-wheel, G, which works a horizontal cog-wheel, H, which turns in opposite directions two spur-wheels, K K, attached respectively to the axes of the drums. M^1 M^2 are two ploughs; each plough is worked to and fro by means of one of the pairs of opposite drums, D^1 D^2, or D^3 D^4, and the chains or ropes attached thereto. Supposing, for example, the plough M^1 to commence operations at *p*, there are two chains or ropes, r^1 r^2, attached to it, one (r^1) in front, and the other (r^2) behind; the former being the chain or rope belonging to the drum D^1, from which it is almost wholly unwound at starting, and the latter being the chain or

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rope belonging to the drum D^2, round which it is, at the same stage of the operations, nearly all coiled. On the engines being set to work, the drum D^1 winds up the chain or rope r^1, and draws forward the plough M^1, while the plough M^1, as it advances, unwinds the rope r^2 from the drum D^2, and brings it along with it forward to the point g, in order that it may be there ready for the return operation of the drum. The rear chain, or rope, r^2, is not attached directly to the plough like the other, but to an outrigger, O, in order that it may be always laid down on the outside of the plough, at a distance from it equal to the breadth desired to be given to the furrows. While the plough M^1 is thus working in one direction, and laying down the chain or rope, by which it is to be worked back to the side from which it started, the other plough M^2 is performing a similar course of operations in the reverse direction. When both ploughs have each traversed the ground once, the engines are moved forwards the breadth of one furrow by means of a chain or rope, V, one end of which is attached to an anchor laid out a-head, as shown in fig. 2, and the other to a drum (not seen in the drawings) connected with the crank-shaft. When again the plough M^1 has ploughed up to the part where the plough M^2 commenced working, the engines are moved forwards a distance equal to the entire space, (say 5 ft.,) between the outermost points of each pair of drums, so as to bring the drums D^1 and D^2 to the breadth of one furrow beyond the point where the plough M^2 has just previously ceased its operations. And in order that the ploughs and ropes, or chains, may be correspondingly advanced, the following arrangements are adopted. Each plough is provided with an extra outrigger (laid loosely on two crutches affixed to the plough frame) of a length equal to the breadth tilled by each plough in each entire remove of the engines, and the breadth of one furrow more, which extra outrigger is substituted for the other, when the plough comes to its last course of work, (in each remove,) so that it shall lay down the chain or rope for the next return course on the advanced line, at which that plough has to resume operations.

Each plough again, when it comes to the end of its last course of work, is directed by the person superintending its operation on to an inclined plane, attached by hinges to the near side of each engine, which gradually raises it free off the ground, and on which it is held till the remove of the engines has been effected. And so the work goes on till the whole field has been ploughed. Rails may be laid down at once for the whole distance which the engines have to travel over, or two lengths only may be made use of, one to be always employed in sustaining the engine, and one to be taken up from behind at each entire remove forward of the engine, and re-screwed into the front ends of the rails left on the ground.

Secondly, Where the field to be tilled is bounded on the two sides along which the engines have to travel by canals or ditches filled with water of depth enough to float boats or punts, I place the engines in such boats or punts, and make the drums to slide on their axes, so that they can be raised or lowered to suit the relative levels of the ground and water. An arrangement of this description is represented in fig. 5 of the annexed engravings. Or should the field, though thus bounded on two sides by canals or wet ditches, happen to be of two great a width to be mastered at one ploughing or tilling, I make use of each canal or ditch as a substitute for one line of rails only, and lay the other on the ground, as in the case first hereinbefore provided for.

Mr. Osborne concludes by describing in his specification several sorts of ploughs proper to be used in combination with power engines on the preceding plan.

BONSER AND PETTITT'S SCREW PLOUGH.

[Patent dated July 14, 1846; Specification enrolled January 14, 1847.]

We have here another mechanical contribution to the cause of agricultural improvement. It is an ingenious application of that most powerful instrument, the screw, to the tilling of land; but how far it is calculated to supersede the straight-going ploughs now in use, practice only can determine. We can suppose that a plough of this sort might be applied with advantage to light soils, but should doubt its applicability to wet and clayey lands. The inventors describe their invention as follows:

Our improvements in machinery for tilling land, consists in employing for the purpose a tiller formed of a cylindrical shaft, or drum, having a number of radial cutters, or prongs, or tines, either straight or curved, attached thereto, at right angles, and arranged round it spiralwise, so as to present the appearance of a screw, and in combining therewith the mechanical auxiliaries neces-

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sary for causing the same to penetrate the soil. The engravings represent several exemplifications of the manner in which the said improvements are carried out. In fig. 1, radial cutters, AA, are employed, which are each sections of a screw, and are attached edgewise to the cylindrical shaft or drum, so as to be at every part of their outer edges at right angles with the axis of the shaft or drum.

Fig. 1.

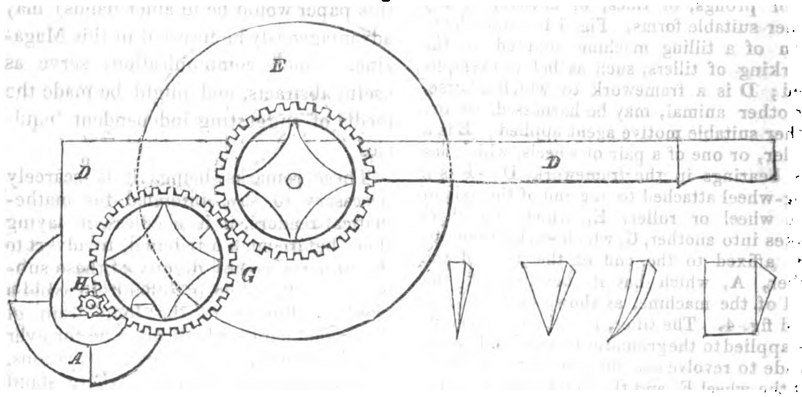


Fig. 2.

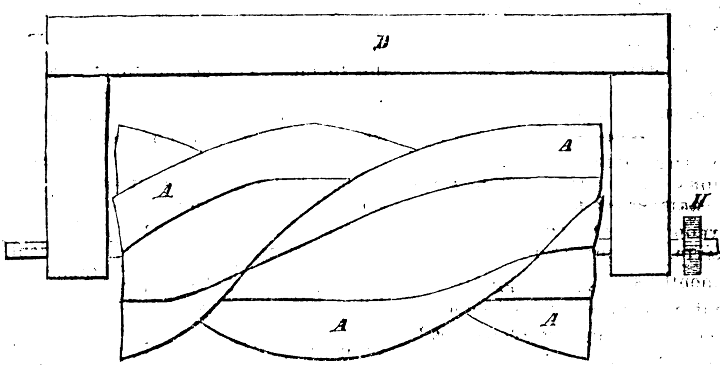
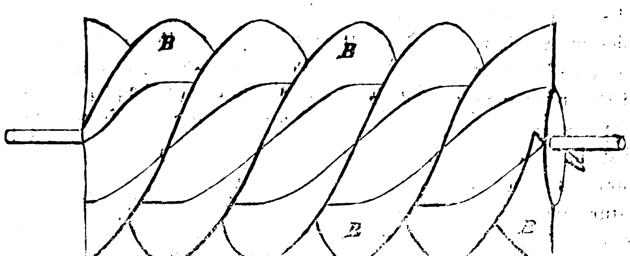


Fig. 3.



In fig. 2, four blades, BB, are wound continuously round the cylindrical shaft or drum, so as to form an entire screw. In fig. 3, four rows of straight prongs, or tines,

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of the shape represented separately in fig. *a*, are affixed in spiral directions to the cylindrical shaft or drum in place of which there may be substituted prongs, or tines, of either of the forms, represented in figs. *b* and *c*, or cutters of the form shown in fig. *d*, or prongs, or tines, or cutters, of any other suitable forms. Fig. 4 is a side-elevation of a tilling machine adapted to the working of tillers, such as before exemplified; D is a framework to which a horse, or other animal, may be harnessed, or any other suitable motive agent applied; E is a roller, or one of a pair of wheels, which has its bearings in the framework, D. F is a cog-wheel attached to one end of the axis of the wheel or roller, E, which cog-wheel takes into another, G, which works a pinion, H, affixed to the end of the axis of the tiller, A, which has its bearings at the tail of the machine, as shown both in fig. 1 and fig. 4. The tiller, it will be observed, is applied to the ground crosswise, and as it is made to revolve and advance by the rotation of the wheel E, and the intermediate gearing, F, G, and H, and the application of suitable motive power thereto, the cutters, or prongs, or tines, not only penetrate, divide, break up, and crush the soil most effectually, but serve to cut and eradicate any weeds, or roots, with which it may happen to be encumbered.

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

No. 1. INTRODUCTORY REMARKS—LINEAR, QUADRATIC, AND CUBIC EQUATIONS.

Some months since, there appeared in the present work two articles by me on the general theory of algebraic equations.* In resuming the subject I have endeavoured, to the best of my ability, to render my remarks interesting and intelligible to all such as are conversant with the principles of algebra, even though they may be, possibly, unversed in certain parts of the above-mentioned departments of that science.

I trust that the contents of these notes will be found as much in conformity with the nature and objects of this periodical, as a purely algebraic investigation on the same subject would be inappropriate and misplaced. While communications of the latter class find fitting receptacles in other contemporary periodicals, it appears to me that papers like the present (or, rather, like what this paper would be in abler hands) may advantageously be inserted in this Magazine. Such communications serve as useful abstracts, and might be made the media of suggesting independent inquiries.

These remarks being, it is scarcely necessary to say, intended for mathematical readers, it is needless, in laying them before such a tribunal, to advert to the importance and dignity of these subjects. Still, I find it difficult to avoid a passing allusion to the long train of illustrious names which must be for ever associated with the theory of equations. In turning over the pages where stand recorded the immortal researches of LAGRANGE and EULER, we feel that the splendour of even their renown is rendered brighter by their labours upon this theme. Yet, despite their toils, and those of other learned and distinguished writers, there is, perhaps, no subject which promises a richer field of discovery to future investigators. Each successive lifting of the veil, while it has revealed some of the mysteries which attend this branch of knowledge, has, at the same time, disclosed the existence of difficulties more formidable, perhaps, than those which have been vanquished.

As well to indicate the true end and purpose of these notes, as to excuse myself from the charge of having overlooked such names as those of VIETA or HORNER, while I mention those of LAGRANGE and EULER, I beg to point out that the subject of these papers is the theory of the *algebraic* solution and transformation of equations. The arithmetical and approximative methods, interesting and important as they are in their theoretical and practical aspects, will have no place in a discussion which, substantially at least, is directed to symbolic results and rigorous solutions. Nor, in mentioning any of these philosophers, must I be supposed to undervalue the numerous others who (not to mention living authors) have to the days of MURPHY, from times far more remote than those of FERREI, turned heir energies in the same direction.

* See *Mech. Mag.*, vol. xliv., p. 404, and vol. xlv., p. 36.

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Neither, taken in the latter point of view, is the theory in itself unalluring. I believe that of those imbued, ever so slightly, with mathematical tastes, there are scarcely any who do not, and that at an early period of their career, cast an inquiring eye upon the subject for its own sake. But, that this may be the case, curiosity must have its full and legitimate scope, and should not be destroyed by the learner passing too rapidly through the first work on algebra put into his hands. His not resting on the preceding parts of the science, prevents him from contemplating and endeavouring to anticipate that which is to succeed. In these latter observations there will not, I think, be found any inconsistency with the sentiments expressed in the second column of page 66 of vol. XLV. of this work. In discharging that part of the pleasing office which I undertook, (a part which had its origin in a suggestion of the editor,) I ought, perhaps, to have dwelt as well on the difference of objects of study as of age in the student. There are many subjects of learning which almost entirely depend, for their successful prosecution, upon the memory, while other branches again, are, in their effective cultivation, as exclusively connected with the understanding.

But, to proceed with the theory of equations. The first class of them which presents itself for notice, is that of linear equations containing one unknown quantity, (x), or, as they might, perhaps, be termed, simple linear equations. The seeming pleonasm may provoke a smile, but I use the term "simple" in the same sense as at page 510 of the last volume; and in treating of the subject under consideration in its full extent, such use will, possibly, be found not without its advantages. On this class little need be said here, further than that by means of the four fundamental operations of algebra, or one or more of them, every equation included in it may be reduced to the form

$$x=a,$$

a being a known quantity. This is a complete solution of the equation.

But the solution of a quadratic equation, involving one unknown quantity, (x), cannot be obtained by means of those operations. It is true that, in certain cases, we may reduce such a quadratic to the form

$$x^2=a^2;$$

but we do not solve the equation till we introduce the new operation of *extracting the square root*, when we obtain $x=a$, or $x=-a$.

The state of a linear equation immediately previously to obtaining its solution as above, is, in general,

$$mx=b\ (=ma);$$

hence this latter equation may be put under the form

$$F'(x)=F'(a).\dots\dots(a)$$

where F′ denotes a function (in this case an algebraic multiple) of the quantity within the brackets which follow it. So, if F″ denote the operation of squaring, the state of *some* quadratics immediately before complete solution, is

$$F''(x)=F''(a).\dots\dots(b)$$

but a perfect quadratic involving one unknown quantity (or, as it might be termed, a perfect simple quadratic) cannot be reduced to such a form. Its form preceding solution, or *type of solution*, is

$$F''(x+a)=F''(b).\dots\dots(bb),$$

where a and b are known quantities. All this appears from the solutions in the books.

If we were to make $b=b\sqrt{-1}$, this last equation would take the form

$$F''(x+a)+F''(b)=0;$$

and by processes similar to those which would be employed in reducing a quadratic, with zero for its right hand member, to this last form, we might represent a general quadratic function of m arbitrary quantities, as the sum of $m+1$ algebraic squares, without determining any of the arbitrary quantities*.

I now proceed to the subject of cubic equations, and if I in this paper do no more than allude to the method handed to us by CARDAN, it is not from any insensibility to its value as a subject for contemplation. We are there for the first time, in the theory of equations, introduced to a method destined to occupy so conspicuous a place in the very highest parts of the science—that of rendering the problem indeterminate by introducing more disposable quantities than there are original equations to be solved—which, in the case of a cubic, presents itself when we substitute the sum of two quantities (y and z) for x its root. A combination of this method (greatly

* See *Mathematician*, vol. i., p. 114, (No. III. July, 1844.)

extended in its range by his peculiar processes*), with that of symmetric functions, is the instrument with which Mr. Jerrard has effected so much for algebra. My own results, such as they are, have been obtained by means depending upon an extension of the processes alluded to at the conclusion of the last paragraph. The given problems are rendered indeterminate, and by this, as by the first-named method, their discussion involves the use of symmetric functions. The peculiar processes of Mr. Jerrard are, however, not necessarily connected with the theory of symmetric functions, nor are those last alluded to.

If we were to denote by F''' the operation of cubing, then there are some cubic equations in x (those wanting their two middle terms) whose *type of solution* is obtainable by writing F'' for F' in the above equation (a). And it is not difficult to see that there are also some cubic equations whose type of solution is deducible from (bb) by writing F''' instead of F'' in that equation. But neither of these is the general type of solution of cubic equations.

The gradually increasing complexity of the type of solution as we ascend the scale of equations, will be best exemplified by referring to a solution of a cubic equation, deprived of its second term, which I gave at page 502 of vol. xxiii, ser. iii, of the *Phil. Mag.*; we thence obtain

$$mF'''(x+p)=F'''(P),$$

where P is a function of p, and p is *not* (originally) a known quantity. We see from this, that the type of solution of a perfect ('simple') cubic equation is

$$F'''(x+m+n)=F'''(P).$$

I must take another opportunity of completing the subject of cubic and biquadratic equations considered in this point of view. The length of the present observations has prevented me, not only from so doing, but also from giving an abstract of two articles of mine which have appeared in the *Phil. Mag.*, subsequently to the publication of my communications to the *Mech. Mag.*, alluded to at the commencement of this paper.

I am, Sir, yours, &c.,
JAMES COCKLE.

2, Church-yard-court, Temple,
January 23, 1847.

* See Jerrard's *Mathematical Researches.* The supplement to part the third bears date July, 1835.

THE COLLEGE FOR CIVIL ENGINEERS AND COLONEL JACKSON.

Sir,—Conscious of integrity, both of principle and conduct, in all that relates to my former connection with the College for Civil Engineers, I shall add nothing to what I have already communicated to you on the subject, but a few observations called for by your late articles.

1. You say I "touched pitch and was defiled." To which I reply, I entered into communication with the founders of the college, not, as you are pleased to say, because I was "eager for a *remunerative* occupation," but for a noble purpose. While connected with them I acted honestly, and with all the straightforwardness of a man who abhors intrigue, and I left them with clean hands. I trust, Sir, I am not losing "temper," nor "writing violently," if I challenge any one to bring forward a single proof to invalidate this declaration, which, however reluctant to speak of myself, I am forced to make in self-defence, seeing that, overstepping your "public duty," you have not confined yourself to legitimate "editorial remarks," but have endeavoured to rob me of what cannot enrich you, but what, next to a clear conscience, I most value—my good name.

2. I am not aware of having made the slightest allusion to my having been "countermined" by anybody; and who the "military engineers" who countermined me can be, I cannot even guess. Though I certainly had reason to be dissatisfied with the council generally, I have studiously avoided complaining of any one in particular.

3. You have coupled with my name that of Colonel Hutchinson, in a way to make it appear as if that gentleman and myself had been in contact; this we never were. I had never heard the name of Colonel Hutchinson till some months, if I remember rightly, after his appointment, consequently long after my own retirement. We have never seen each other, that I know of, and there has never been any communication between us beyond a very short and courteous note I once received from the Colonel, and to which I replied by one equally short and civil.

4. You are quite in error, at least as far as I am concerned, in supposing the article in the *Artizan* to be a "feeler to ascertain whether the public will support

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me in the formation of a new college, as a rival to that at Putney." The fact respecting the article in question is simply this:—Knowing that different articles respecting the college had appeared in the *Artizan*, and regretting that misrepresentation, either against or in favour of the college, should be made public, I called upon the editor of that paper, and told him that, "if he were inclined to say anything more about the college, I would gladly furnish him with every document in my possession, in order that he might be well informed of the facts, which he was perfectly free to make any use of he might think proper." If he has expressed a desire that I should be connected with any establishment for engineering education, it can only be from his own opinion of my fitness, formed upon a careful examination of the documents alluded to; and though I feel gratified by his good opinion, he can testify to my having disclaimed all intention of again entering upon any such undertaking as the founding of a new college.

5. As for my plan of studies, you have entirely misunderstood it; but to go into details upon this subject is quite unnecessary. My plan, which, indeed, is only a slight modification of what the most extensive experience in other countries has proved to be eminently successful, should be considered in all its bearings to be properly judged of; but as no single portion of it has ever been tried, and probably never will be, it would be quite superfluous to say anything about it. For my ideas generally on engineering education, I beg to refer you, and those whom it may concern, not to the unconnected statement in the *Artizan*, but to the original paper in No. IX. of the *Surveyor, Engineer, and Architect*, edited by the late Mr. Mudie, a careful perusal of which will, with the candid, supply, I feel assured, satisfactory answers to the animadversions in your last articles, in respect to religious instruction and every other particular. That essay, I am proud to say, has received the warmest commendation of professional men, and others well qualified to form a correct judgment on the subject; and yourself, Sir, will, I trust, view my notions, as well as my principles, in a different light from what you have hitherto done, when you will have given that paper an attentive and unbiassed perusal.

I sincerely wish the establishment at Putney every success, both for the honour of its present principal, whom I have always heard spoken of in high terms, and for the sake of the pupils and the country. I know nothing of the system there followed, and have no business to meddle with it; but I may be allowed to say, that, if it be that which generally maintains in our schools, it is essentially defective.

I can hardly hope, Sir, to obtain from you any acknowledgment of your having totally misrepresented me, and must conclude, as I began, by resting satisfied with my own consciousness of right, and the esteem of those who know me.

Nothing shall again induce me to say another word on a subject so personal, and of which your readers must be heartily tired.

I am, Sir, yours, &c.,

J. R. JACKSON.

Jan. 25, 1847.

[For an editorial note on the subject of this letter see Notice to Correspondents, p. 119.]

THE PERPETUAL MOTION FOUND AT LAST!!!

Sir,—In the Cambridge Senate-house problems, for this year, there is the following:

"A circular disc is suspended by a fine wire attached to the centre, and immersed in a fluid horizontally: the wire being suddenly turned through a given angle, determine the motion of the disc, supposing each element of the surface acted on by a friction varying as the velocity, and show that the successive arcs described from rest to rest are in geometric progression. Show, also, that *if the friction exceed a certain quantity, the disc will not come to rest at all.*"

Taking the force of torsion to be proportional to the angle of torsion, the question leads to the following differential equation:

$\frac{d^2\theta}{dt^2} - 2m.\frac{d\theta}{dt} + n^2\theta = 0$, m and n being constant quantities.

The solution of this equation is (*Hymer's Diff. Equations*, page 65,)

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$$\theta = e^{mt} \times \left[C. \cos \sqrt{n^2-m^2}.t + C'. \sin \sqrt{n^2-m^2}.t.\right] \quad \text{C and C}' \text{ being constants.}$$

$$\therefore \frac{d\theta}{dt} = m.e^{mt} \times \left[C. \cos \sqrt{n^2-m^2}.t + C'. \sin \sqrt{n^2-m^2}.t\right]$$

$$+ e^{mt} \times \left[C'. \sqrt{n^2-m^2}. \cos \sqrt{n^2-m^2}.t - C. \sqrt{n^2-m^2}. \sin \sqrt{n^2-m^2}.t\right].$$

When the particle comes to rest, $\frac{d\theta}{dt} = 0$; denote $\sqrt{n^2-m^2}$ by a, then,

$$m.\left\{C. \cos(at) + C'. \sin(at)\right\} = Ca. \sin(at) - C'.a. \cos(at).$$

$$\therefore \tan(at) = \frac{Cm + C'a}{Ca - C'n}. \text{ and } t = \frac{1}{a}. \tan^{-1} \frac{Cm + C'a}{Ca - C'm} = \beta. \text{ Suppose}$$

$$\therefore \text{ for this value of } (t), \text{ we have } \theta = e^{m\beta} \times \text{a constant quantity,}$$
$$= e^{m\beta} \times A.$$

If θ' denote the angle described in the second oscillation, and θ'' that in the third,

$$\theta' = e^{m(\beta+\pi)} \times A, \; \theta'' = e^{m(\beta+2\pi)} \times A,$$

and so on; and it is evident that these angles, and therefore the arcs which they measure, are in geometrical progression.

Also, it is evident, that if m^2 is greater than n^2, that is, if the friction exceeds a certain quantity, the expression for $\frac{d\theta}{dt}$ involves impossible quantities, and hence it is concluded that the angular velocity can never become nothing under these circumstances. In other words, you have only to find a fluid in which the friction is of a certain amount on a given material, as compared with the force of torsion of a certain wire, and you will get that great desideratum—a perpetual motion!

I need hardly say, that this strange conclusion can only be satisfactorily explained by a reference to the mode in which we have obtained the solution of the differential equation, under the form given above. I am, Sir, yours, &c.,

A. H.

P. S. I have no doubt you will be glad to learn that Mr. Adams' discovery is fully appreciated in his own college, the Master and Fellows of St. John's being about to establish a valuable mathematical prize, to be connected with his name, and to commemorate one who, as Professor Challis (who, I may remark, has behaved most honourably and liberally throughout the whole affair) has justly said, "by his talents and labours has done honour to the university, and maintained the scientific reputation of the country."—(*Cambridge Chronicle.*) The investigation itself is published in the *Nautical Almanack*, just out, for 1851. It will be strange if Arago does not find out that the calculations themselves have been stolen from Mr. "Philosopher" Le Verrier's bureau!

WATERWORKS AND SEWAGE.

In the supply of that important necessary of life—water, which was so much studied by the ancients, but so greatly neglected in the middle ages, great progress has been made in modern times. Spring-water was formerly conveyed to public reservoirs in the city of London, by leaden pipes from various springs in the vicinity: viz., from Tyburn in 1236, from Highbury in 1438, from Hackney in 1535, from Hampstead in 1543, and from Hoxton in 1546. For these useful works the citizens were indebted to the munificence of several lord mayors and other individuals, but those of Hampstead and Highgate are the only ones now remaining. The open watercourse or conduit from Dartmoor, 24 miles long, for supplying Plymouth with water, commenced by Sir Francis Drake, in the reign of Elizabeth, and the New River, for the supply of London, 39 miles long, 28 feet wide, and 4 feet deep, falling 3 inches in a mile, by Sir Hugh Myddleton, in 1613, are considerable works of the kind, and were planned and

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executed at the cost of those distinguished individuals. Myddleton was, in fact, ruined by it, and adopted the profession of an engineer and surveyor to obtain a livelihood.

London Bridge Waterworks were commenced by Morice, in 1582, with water-wheels turned by the flood and ebb current of the Thames, passing through the purposely-contracted arches of old London Bridge, and working pumps for the supply of water to the metropolis; it was the earliest example of public water service by pumps and mechanical power which enabled water to be distributed in pipes to dwelling-houses. Previously, water had only been supplied to public cisterns, from whence it was conveyed, at great expense and inconvenience, in buckets and water-carts. In addition to the London Bridge and New River, several minor establishments of the same kind were afterwards erected on the banks of the Thames, to supply separate districts in their immediate vicinity. Some were worked by water-wheels on the sewers which discharged themselves into the Thames, others by horses, and one by a windmill. That at Broken Wharf in 1594, at Shadwell and York Buildings, worked by horses, and at Chelsea by water-wheels, may be mentioned. Early in last century, when the old cisterns had nearly disappeared, and water was supplied to the dwellings, a great improvement took place by the application of the steam-engine (which had then begun to develope its extraordinary powers) to the York Buildings Waterworks by Savery, in 1710, and afterwards by Newcomen in 1730. Newcomen's engines were subsequently applied at Chelsea, Shadwell, Stratford, London Bridge, and the New River Waterworks. As soon as Watt had brought his improvements into operation for pumping water, his engines were applied at each of the above water works by degrees, in addition to the old engines; thus a comparison between them could easily be made, and soon showed the superiority of Watt's engine in every respect. They were thus applied at Shadwell and Chelsea Waterworks in 1778, at London Bridge, and Lambeth soon after, and at the York Buildings in 1804. The usual mode for the old engines was to pump the water into a cistern, at the top of a high tower, and from thence it descended through pipes, to the districts and buildings where it was required; the engine was thus always kept to its full load, whether necessary or not, and a waste of power ensued. Air vessels were afterwards added to the pumps at Chelsea, and subsequently became general; the air in the vessels being compressed, acted by expansion and contraction on the water, so as to force it with regularity through the pipes, without going up to the cistern. Smeaton, who had constructed water-wheels for pumping at Stratford in 1763, and at London Bridge in 1767, where towers were employed, afterwards became the principal proprietor of the Deptford Waterworks, and in 1773 constructed a water-wheel for pumping water from the Ravensbourne, without a tower. The machine is still in existence, although steam-engines have been subsequently applied. About 1810, Boulton and Watt's improved pumping-engines, constructed wholly of metal, and erected in handsome substantial buildings of brick and stone, with large air-vessels for pumping direct into the pipes, became generally adopted at all the London waterworks; cast-iron pipes were substituted for the old ones of wood. The new engines being more powerful, and the cast iron pipes stronger, enabled water to be distributed to cisterns on the tops of dwelling-houses, hence denominated the high service. Stone pipes were tried at the Grand Junction Waterworks, but failed, and iron pipes were substituted. Filtering reservoirs upon a large scale were constructed at Chelsea, by Simpson, in 1830, and subsequently at other places, with complete success, and are now universally employed. The water is now generally taken from the Thames above the town, where it is least adulterated. The old waterworks lower down the river, viz., York Buildings, London Bridge, the Borough, and Shadwell, have been abandoned, and new places chosen at Hammersmith and Brentford, higher up the river, and at Old Ford, upon the river Lea; the river water is received into capacious settling, or filtering reservoirs, and distributed by steam engines to the respective districts. Latterly, powerful condensing steam engines, very similar to Watt's, but worked by high pressure steam with great expansive action, on the system introduced by Woolf, in Cornwall, for deep mines, were introduced by Wicksteed, in 1840, at the East London Waterworks, and have since been adopted by other companies with advantage in saving fuel. The double cylinder high-pressure condensing engine, with great expansive action, on the system of Hornblower, have also been introduced by Woolf, Hall, and Rennie, and applied to work mills with success. Waterworks, similar to those in the metropolis, have been erected at Edinburgh, Glasgow, Dublin, Manchester, Liverpool, and all the principal towns in the kingdom. At Glasgow one of the last engineering efforts of Watt was to suggest the idea of laying a pipe under the Clyde, to bring water to the city from the opposite side of the river; this was to have been effected by making the pipe

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with flexible ball and socket joints, uniting the whole together in one piece, and closing it at each end, floating it to its position, and sinking it. Rennie effected a similar operation at York Buildings in 1810. The increased means for the supply of water, and the economy and punctuality with which it is distributed, has occasioned a greater consumption, and induced a degree of cleanliness throughout all classes, which has tended to augment the comfort and health of the community. Still the system is capable of improvement; larger reservoirs and more copious supplies are necessary.

Artesian wells, which appear to have been known to the ancients, and have been common in France and Italy, were introduced into this country about the year 1790, it is said, by Vulliamy, near London. The system consists in boring holes or wells through the superincumbent strata, impervious to water, until they reach the porous strata where water abounds; the pressure then acting according to the level from whence the water is derived, forces it upwards through the holes, frequently to some height above the surface; these have since been multiplied all over the kingdom during the present century, and latterly in Trafalgar-square, for supplying the first public fountains which have been erected in the metropolis. These fountains, though upon a small scale, are a beginning, and it may be hoped that this example will be generally followed for the ornament of this great city, which, although perhaps the best supplied with water in the world, has not been adorned with fountains, which are so general and are constructed upon such a grand scale at Paris, Rome, and almost all the other great cities in Europe, adding so much to their magnificence and salubrity. In carrying out the improvements above mentioned for the supply of water, the names of Smeaton, Watt, Mylne, Rennie, Telford, Simpson, Bateman, Anderson, Clark, Wicksteed, Walker, Martin, and others, must not be forgotten, and we shall no doubt witness efforts upon a still greater scale in future. Projects for bringing a large supply from the Thames above Windsor, by Rennie; also from the Colne and Wandle, and [illegible] and elsewhere, by Telford, Rennie, and others, have long been in agitation, and sooner or later may be effected with advantage to the metropolis.

Connected with the supply of water for domestic purposes, we must not omit the important subject of sewage, or surface drainage, upon the due operation of which the health of the community so much depends. Sewers appear to have attracted notice at an early period, and during the reign of Henry VIII. commissioners were appointed with extensive powers to levy rates for, and to see them properly carried into effect; but until under ground or covered sewers were adopted, all the surface water from the adjacent hills and country, as well as the refuse from the buildings, was discharged into open ditches and street gutters, which, passing through the centre of the town, accumulated, and occasionally remaining stagnant for a considerable period, produced a degree of effluvia and malaria extremely prejudicial to the health of the inhabitants. This was remedied, to a certain extent, by covering over the open drains; but the bottoms of these were not low enough, and the want of surface drains continued. By degrees, covered sewers, of enlarged capacity, entirely of brickwork, were introduced; the importance of the subject then became duly appreciated and studied; sewers were laid out upon a general and enlarged system; main, subsidiary, and surface drains; and cesspools of a proper form, construction, and capacity, adapted to each other, and to the several districts they were to drain, were designed, and, in many cases, carried into effect. The subject is still under consideration, and improvements are being daily effected, although much still remains to be done in the form, capacity, inclination, distribution, and arrangement of sewers, not only in the metropolis,* but in almost all the principal towns of the kingdom, before the system can be said to be complete. The removal of old London Bridge, by which a fall of about 5 feet at low water has been gained, has been of immense advantage in improving the drainage of the metropolis; and it only remains for this great improvement to be carried out further, by removing the shoals and regulating the high and low-water channel of the river, by dredging and other means, but to be cautious in contracting the width; it is greatly to be desired that this important work should be speedily carried into effect, upon a general scientific system, which, if properly done, would confer the greatest benefits upon the extensive and populous districts, draining into and bordering upon the Thames, as well as the navigation of this noble river, upon the proper maintenance of which the immense commercial wealth, and prosperity of this great metropolis and its adjoining populous vicinity depends. In the improvements of sewerage, Cubitt, Barry, Donaldson, Gwilt, Hardwick, Nash, Smirke, Soane, Walker, Rennie, Roe, and others, have been conspicuous.—*Sir John Rennie's Address to the Institution of Civil Engineers.*

* There are nearly 500 miles of covered sewers in the metropolis.

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BUILDING MATERIALS.

In wooden bridges, little was formerly done in Britain beyond the common pile bridge. These were formed by rows of piles for piers, driven at short distances from each other, and connected together by straight girders planked across to form the roadway, with a wooden railing on each side. Of this kind of construction, the bridges of Londonderry, across the Foyle, Waterford, across the Suir, Battersea, Fulham, and others, across the Thames, are examples. In some cases, this system was extended by adopting larger openings, having diagonal struts, or butting pieces, between the underside of the girders and the piles forming the piers, in order to reduce the bearing of the girders, and thus give them greater stability. The straight trussed frame or girder, so much used in America, was employed by Rennie, to a considerable extent, as service bridges, during the construction of the Waterloo and Southwark bridges, in 1809—19, and at New London Bridge, in 1825—31, with openings of above 100 feet, capable of supporting the heaviest weights. The late Colonel By, of the Royal Engineers, gave an account of a bridge of this description, said to have been built across the Terrebonne, a large river near Montreal, in Canada, 600 feet span between the piers. It is said that this was carried into effect, and actually stood for a short time; but in consequence of its having been badly constructed, it required heavy repairs, and whilst these were being effected, the whole structure came down, and was carried away by the floods. The trussed system has been applied with considerable success in some well-constructed bridges across the Tyne, for the Newcastle and Carlisle Railway, by Blackmore, and in several other places. The system of Wiebiking, of combining small curved pieces of timber connected together in the form of an arch, adapted for large spans, was first introduced, I believe, on the Ancholme, in 1826, when a bridge of 100 feet span was constructed with complete success. This has been used by Green, in the viaducts for the Newcastle and North Shields Railway; and has been followed by others also. Price, long ago, proposed a similar system; but the scarcity and dearness of timber, and the prevalent use of iron, probably prevented its application before. The lattice bridge, of American origin, has latterly been introduced on the Birmingham and Gloucester Railway by Moorsom, and on the Dublin and Drogheda Railway by M'Neil, and as they are economical and simple in their construction, they are applicable in some cases with advantage.

In the designing and constructing of bridges of stone, wood, cast and wrought-iron, an accurate knowledge of the strength of materials is peculiarly important, nay, absolutely indispensable; and the profession is much indebted to George Rennie, who commenced a series of investigations on this subject in 1817, which were communicated to the Royal Society, and published in their Transactions in 1818. These experiments were amongst the first to determine with precision the absolute and relative strengths of materials, under the effects of tension and compression. He subsequently made above six hundred experiments in 1827 on the friction of plane and round surfaces, with and without unguents, under the different circumstances of time, surface, and pressure, which were published in the Philosophical Transactions, in 1828. In 1830 he also made experiments on the friction and resistance of fluids, which were published in 1831. Morin's experiments did not appear until 1834—Tredgold, Barlow, Fairbairn, Hodgkinson, Wood, and others, have since carried these experiments to a greater extent.

Concrete, a mixture of gravel, sand, lime, and other cements in certain proportions, was well known to the ancients, and in conjunction with the invaluable natural cement, Pozzolana, was applied with the greatest success in the then numerous moles and other submarine works, and its use has been still continued in Italy to the present day. Wren is said to have used it for a portion of the foundation of St. Paul's, where it was defective. Semple also alludes to it in 1776. Its use appears to have been discontinued for a time, but recently to have been resumed. Rennie proposed it for the foundation of the Penitentiary in 1811; Smirke and others followed in the same track, and now the employment of concrete for the foundations of buildings has become nearly universal, wherever it is necessary.

Brick has been much used for bridges over canals and drains by Rennie, and in railway bridges by Stephenson, Cubitt, Locke, Rastrick, and others; and, latterly, it has been carried to a far greater extent by Brunel in his bridge across the Thames at Maidenhead, for the Great Western Railway. It consists of two semi-elliptical arches, each 130 feet span, and rising 24 feet; they are built wholly of brick, in Roman cement.

Roman cement, discovered by Parker, in 1796, is chiefly made from a stone found on the shores of the Isle of Sheppy, near Sheerness; it is burnt in a kiln, and when ground into fine powder, possesses the peculiar property of setting hard immediately, although exposed to water, which renders it

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very valuable in hydraulic works. It had been little used in public works until it was adopted by Rennie and others, It was extensively employed in the naval works at Sheerness and elsewhere, and is now universally employed in buildings where immediate induration or setting is required, in order to prevent the action of water, or where any settlement from insistent weight would be injurious. Latterly, Roman cement stone has been found at Harwich and other places. Aberthaw, Lyme, Barrow and other limestones also possess valuable properties for water-works. The success of buildings depends materially upon the cement or mortar employed; and much has been done by Smeaton, Rennie, and Telford in the selection of the best lime, sand, and other materials, in combining them in proper proportions for the respective parts of the works where they were employed, and in the application of machinery for the more thoroughly mixing up and incorporating the materials together. Great credit is also due to Higgins, Pasley, Donaldson, Smith and Godwin for their valuable experiments and treatises upon this important subject.*

Additional strength has been given to brick structures, by the introduction of bands of thin hoop iron between the courses; this improvement was first generally introduced by Sir M. I. Brunel.—*Sir John Rennie's Address to the Institution of Civil Engineers.*

RECOVERY OF SUNKEN AND STRANDED VESSELS.

A mode of raising sunken vessels or recovering their cargo, has been patented within the year, which is said to have proved very successful. Circumstances are often such that it could undoubtedly be very advantageously employed. The description of the apparatus and mode of operating are as follows, nearly in the words of the inventor:

"The nature of my invention consists in the employment of a cloth or flexible caisson to surround the wreck for the purpose of excluding the surrounding waters, so that the water within the vessel and caisson can be pumped out, and in the employment of a frame or frames to be erected above the vessel for the purpose of giving access to any part of the vessel; and also in connecting with such cloth or flexible caisson a pump or pumps, suspended to a steamboat or other vessel carrying the motive force for pumping water from the caisson and wreck.

"The flexible caisson is made of canvass or other cloth, of sufficient size to surround and encompass, and extend sufficiently low to cover all the leaks in the wreck. It should be made water-proof by any of the known means, and of sufficient strength, by repeated layers, to resist the pressure of water. The lower edge is lapped over, or hemmed, to embrace a chain which extends entirely around, to act as a sinker, and enable the pressure of the surrounding water to force the cloth or caisson up to and under the bottom of the wreck.

"For the purpose of getting access to the cargo of a wrecked vessel, I employ in combination with the flexible caisson a frame, which I denominate a platform, the construction of which should be varied to suit the peculiar situation and condition of the wrecked vessel. I shall here set forth the mode most generally applicable. In the first place, I make a frame about twelve feet in length, and as wide as the wrecked vessel, enlarging the same if it becomes necessary in the operation of saving the wreck or cargo. The said frame consists of two bents placed twelve feet apart, and secured together by four girts, two at each end. When the frame is thus constructed, I attach it to the vessel by means of bolts, screws, chains, or other fastening, so as to render it a firm fixture to the wrecked vessel. The frame is then made to receive timbers and floorings, putting it in readiness for operations on the wreck.

"When the wreck is wholly under water, I build a temporary frame around the sides of the wreck, extending from the deck or uppermost part of the wreck above the surface of the water. When the wreck is only partially covered with water, the temporary frame may only extend around that part of the wreck which is submerged; and in case the upper part of the wreck is out of the water, but a part of it is stove in or broken, or is otherwise rendered so leaky as to interfere materially with the water being pumped out, I make the frame-work of such extent, and in such places as may be required by the particular circumstances.

"The flexible caisson encircles this platform or frame as well as the vessel, and by this means access can be had to any part of the inside of the vessel for the purpose of removing any portion of the cargo, or closing up the leaks, if the intention be to raise

* From the valuable researches of these authors it appears, that the hydraulic cements contain considerable portions of silica and alumina, and in some cases metallic oxides; and, where natural hydraulic cements cannot be obtained, they may be produced artificially, by the combination of these ingredients in the proper proportions.

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the wreck."—*Report of American Commission of Patents.*

PRAIRIE CARS.

A striking improvement is the prairie car. This invention is not presented with the noisy pretensions which frequently characterize the advent of new discoveries, but seems to claim for itself no more than experiments justify us in believing it can accomplish. It is not intended to rival the railroad system, where that can be successfully established and sustained; but it is intended for prairies and other level and unbroken grounds, where no road is necessary to be built for it, and where the amount of travel and transportation will not justify the construction of railroads. Within these limits it premises great usefulness, as there are extensive regions in the west which present an appropriate field for its successful operations.

The prairie car consists of a frame of proper strength and dimensions to sustain the steam-engine or other superincumbent weight. This frame, instead of resting upon ordinary wheels, is supported by hollow cylinders of a convenient diameter, and very wide tread. These cylinders are placed upon axles, and constitute the driving wheels. The cylinders are made hollow, for lightness, and close, to prevent the entrance of mud or other matter, and the tread is very broad, to prevent sinking into soft earth, &c. Two smaller wheels of similar construction are placed upon axles in a separate frame at one end of the car, to guide it. This frame turns upon a pivot, by which it is connected with the main frame, and is operated by such means as are convenient for steering. The foregoing are the prominent features of the car, or locomotive. The propelling power is applied to the driving wheels in any convenient way. There is much originality in the idea of traversing the prairies by steam cars, upon their natural and unbroken surfaces, and much merit in adapting the cars to the nature of this novel undertaking.—*Ibid.*

MAGNETIC STEAM GAUGE.

The construction and operation of this instrument are very simple, and will be fully understood, both in character and importance, from the following preamble in the words of the inventor:

"The importance of a reliable means of indicating the height of water in steam-boilers is now universally admitted by engineers, for the reason indicated by science and established by experience, that the deficiency of water in boilers is the principal if not the only source of explosions; and hence the many attempts which have been made to obtain an apparatus for this purpose, which, whilst it can be relied on, will at the same time be in such a condition as to insure the observance of the engineer. But, so far as I have been informed, all the attempts heretofore made have failed, because of the difficulty of forming the connection between the water inside the boiler and an indicator, which, to be practically available to the engineer, must be outside. A float resting on the water, and communicating with an index, a lever, or other device outside, through a stuffing-box, has generally been resorted to, but it is evident that the friction of the stuffing-box will prevent the working of such an apparatus, which must be sensitive, and which necessarily possesses very little power, as the buoyancy of the float is its only actuating force. To avoid this difficulty, attempts have been made to put the indicator within the boiler by covering it with glass, but with as little success, for the action of high temperatures, it is known, renders the glass opaque.

"My invention, it is believed, will avoid all these difficulties; and it consists simply in attaching a magnet to the axis of motion of a wheel or lever, to which the float is suspended or attached, to communicate motion by attraction and repulsion, to an index needle turning on an axis outside the boiler, and separated from the magnet by a steam-tight plate."—*Ibid.*

ON THE GUN-COTTON. BY PROFESSOR BRANDE.

Abstract of a Lecture delivered at the Royal Institution.

Between fifteen and sixteen years ago, Braconnot ascertained that starch, wood-shavings, sawdust, linen and cotton fabrics, when treated with concentrated nitric acid, produced a sort of gelatinous substance, which coagulated into a white mass on the addition of water. Braconnot called this substance *xyloidine*, from its resemblance, in some respects, to ligneous matter. Xyloidine is, as Professor Brande demonstrated by experiment, highly inflammable. Two years after Braconnot's investigations, Pelouze published some inquiries into the nature and properties of xyloidine. He ascertained that starch, when converted into this substance, exchanged an atom of its constituent water for an atom of nitric acid. He also observed that it took fire at a temperature of about 360°. This facility of

combustion, and the fact of its burning without leaving residue, induced Pelouze to cover paper and other textures with a film of xyloïdine, by plunging these substances into dilute nitric acid. When thus prepared, they resemble parchment in appearance, are very inflammable, and impervious to moisture. Pelouze suggested the use of paper treated in this manner for the purposes of artillery. Such was the state of science on this subject when, in the course of last year, Professor Schönbein examined the effect produced by a mixture of sulphuric and nitric acids on organic bodies. One purpose of his research was to ascertain the qualities of a form of matter which he calls *ozone*. On this subject we cannot digress further than by presenting the following equation, which will convey Schönbein's views to our chemical readers:

$$NO_5HO + SO_3HO = NO_4SO_2 + 2\,HO_2$$

(HO_2, the symbol of the oxy-water of Thenard being also that of Schönbein's ozone). It was in the course of these researches that Schönbein found that each of those singularly allied bodies, sugar, starch, gum, and woody fibre, assumed its own peculiar state when brought under the influence of the mixed acids; and that woody fibre in the form of tow, cotton-wool, &c., when plunged into a mixture of these acids, becomes a highly explosive compound. The substance thus prepared was exhibited, on Professor Schönbein's behalf, by Mr. Grove, on the 15th of September last, to the British Association, and (as Professor Brande pointedly observed) it was not till that time that the supposed claims of others to any share in this discovery were advanced. Professor Brande proceeded, 2ndly, to describe the preparation and properties of the gun-cotton. Having been first cleansed and carded, cotton, according to Schönbein's process, is immersed for a short time in a mixture of two parts (by measure) of sulphuric with one of nitric acid. It is then taken out, well washed with water, and carefully dried. The cotton is then found to have acquired the following properties:—Though identical with common cotton (even under the microscope) in ordinary light, it appears dark when viewed through a magnifier in polarized light. It may be repeatedly moistened with water and dried without losing its acquired properties. It is an insulator of electricity, being powerfully *negatively-electric*. It is singularly hygrometric. It catches fire at a temperature of about 360°, and burns with far greater rapidity than gunpowder; and yet the combustion of a train of this cotton can be stopped in its course by strong pressure — an important circumstance as bearing on its application. The products of its combustion are carbonic and nitric oxides, carbonic and oxalic acids, cyanogen, nitrogen, and steam.—3rdly, In respect to the uses of gun-cotton, Professor Brande remarked, that it was more energetic than gunpowder. From experiments made at the mills of Messrs. Hall and Co., the patentees, it would appear that about one half ounce of gun-cotton carried a 68 lb. shot 255 feet from an 8-inch mortar; while 2 ounces of gunpowder carried a shot of the same weight, from the same gun, only 152 feet. The average of four fires from a tiger-rifle, No. 14 gauge, charged with from 60 to 80 grains of gunpowder, carried a ball through three *inch elm boards* packed closely together; while 30 grains of gun-cotton carried a ball, under the same circumstances, through *six such boards*. Adverting, in conclusion, to the alleged disadvantages and advantages of Schönbein's invention, Professor Brande remarked of the former that it was hardly just to ascribe them to what was so recently known, and, therefore, so imperfectly examined as an article of commerce. The use of gun-cotton in fire-arms has been said to be attended with the following disadvantages:—That the effects are less regular than those of gunpowder.—That it is more dangerous, because inflaming at a lower temperature.—That it does not take fire when compressed in tubes.—That it burns slowly in all kinds of cartridges.—That guns and pistols must be altered to admit of its use.—That it is not adapted for the use of the army.—That the barrel of the gun is moistened by the water produced during combustion. The advantages, on the other hand, may be stated as follows:—Its extreme cleanliness, leaving no residue after combustion.—Its freedom from all bad smell.—The facility and the safety of its preparation.—The possessing treble the force of gunpowder.—Its explosion producing no smoke and less noise than that of gunpowder.—Its filamentary nature admitting of its being used overhead in mining operations.—Its not being liable (as a granulated substance is) to the accidents of leakage.—Its occasioning very little recoil.—*Athenæum Report.*

A paper has been also read at the Chemical Society by R. Porrett, Esq., "On the Existence of a New Organic Base in Gun-cotton." The author is of opinion that, in the action of nitric acid on lignin, or the fibre of cotton, two equivalents of oxygen are transferred from the acid to the lignin; the former of which, accordingly becomes nitrous acid, and the latter a new alkaline

body, which is named *lignia*. Gun-cotton is thus represented as the nitrite of lignia. In support of this view, it is shown that gun-cotton dissolves entirely in strong nitric or sulphuric acid under 180°, without decomposition, as it may be precipitated from the acid solutions by the addition of water, insoluble, and chemically unchanged. But when a higher temperature is applied to these solutions, nitrous acid is copiously evolved, and in the opinion of the author a nitrate or a sulphate of lignia is formed. These supposed salts differ from the nitrite in being soluble in water. A substance of a greyish white colour is precipitated from them by an alkaline carbonate, which is the new base. The latter is soluble in water, very sparingly soluble in alcohol, and wholly insoluble in ether. It exhibited an alkaline reaction with test-paper; but it is doubtful whether it has been procured entirely free from a fixed alkaline carbonate. No crystalline salt of lignia was formed.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 94.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

George Adams, of Fleet-street, London, mathematical instrument-maker, and *Richard Jack*, late of the parish of St. Martin, but now of the Parish of St. James, Westminster, gent.: specification for an instrument or quadrant for taking the altitude of the sun or moon at sea or land, but more especially at sea, by refraction, in which, by the means of a lens, the object is thrown upon the arch of a curve, and is made to coincide with the horizon seen through the said arch, or any substance so adapted thereto as to admit the rays to pass through or by it in a backward observation, and the said arch is by a particular contrivance rendered moveable, so as in all positions of the instrument to preserve the coincidence of the object and horizon, and for other purposes. Also for a refracting telescope, of a new construction, consisting of four spherical lenses, which may be all of different focal distances, or only two of different focal distances, and the other two of equal focal distances, which may be used with or without the quadrant, whereby distant objects are seen distinct and larger with these when only 4 feet long than with telescopes of the ordinary construction, which are 12 or 15 feet long. May 25, last past; August 31, 24 Geo. 2, 1750.

William Pennington, of the parish of Kirkby, in Kendale (Westmorland,) milnwright: specification for a machine or engine for pricking the leathers of wool, silk, cotton, or any other cards, by which invention the making of wool cards will be very much facilitated. A parchment schedule of drawings of the invention is attached. Oct. 13, 24 Geo. 2; January 18, 1750.

William Perkins, of the parish of St. Magnus, in the city of London, gent.: specification for a machine for grinding corn, or for raising water to drain fenn lands, coal pits, mines, &c., and for forcing up water with a perpetual stream for extinguishing fire, supplying cities, &c. A drawing and description of the above machines are annexed. Nov. 24, 24 Geo. 2; March 12, 1750.

John Elliott, of College-street, Westminster, Middlesex, gent.: specification for "An art and method of printing, painting, staining, and colouring of flannels and other woollens," never performed in this country, by models cut according to the pattern intended. Jan. 22, last past; May 20, 24 Geo. 2, 1751.

Osmond Cooke, distiller, of the city of London: specification for a new method of cleansing and improving British spirits to much greater perfection than hath hitherto been practised, which makes a refined spirit as good, wholesome, and in every respect equal to the best Holland or Cologn Geneva imported from Holland or Germany. February—, last past; May 25, 24 Geo. 2, 1751.

Willoughby Marchant, of the parish of St. Ann (Middlesex), gent:: specification for "An invention of making hard soap, commonly called Castile soap." April 4, 24 Geo. 2; June 19, 1751.

Joseph Fraunces, of Daventry (Northampton), apothecary: specification for a chemical preparation called "Female Strengthening Elixir," &c. March 27, 24 Geo. 2; June 24, 1751.

John Baker, of Bakewell (Derby), whitner and hosier: specification pursuant to patent granted to the said *John Baker*, and John Barker, of Edensor (Derby), soap-boiler and chandler, for "A new method of making fine pot ashes, commonly called pearl ashes, as good as any imported from abroad." April 18, 24 Geo. 2; August 2, 1751.

Richard Rock, of the parish of St. Bridget, otherwise Brides, London, licentiate in medicine: specification for "An Electuary," &c. Oct. 17, 25 Geo. 2; Jan. 15, 1752.

James Langley, of the parish of St. Luke, Middlesex, surgeon: specification for "A new method of managing or manufacturing

some English vegetables, and other things of home produce, so as to make from them several very useful commodities, one of which is an oil which gives almost present ease in fits of the gravel and stone, is the greatest antiscorbutic and pectoral of anything of the kind, and as fine for eating as the best olive oil." The vegetables are mustard, angelica daucus or wild carrot, fennel, cummin, and aniseed. From the mustard seed an oil is extracted; after the oil is out, the best flower of mustard is made; the bran is then fermented and distilled, and a wholesome spirit obtained, also a hot liquor, good for pickle, scurvy, &c.: vinegar is likewise obtained from the bran after fermenting it. To make the oil for the gravel, &c., the oil from the mustard seed is mixed with an oil extracted from the seeds of all the other vegetables above named. From this oil thus prepared a soap is made (with a lixivium of quick lime, pot ash, and the ashes of the bran from the mustard) which is likewise good for the gravel, &c. The other things of home produce to be turned to use are the offals, shreds and parings of leather, hitherto burnt or used as manure, which are to be manufactured into a paper for great guns, also for cartridges, and will answer the purpose as well as parchment: also to be manufactured into sheets and boards for the use of paperhangers and bookbinders. A paper may likewise be made from offal cotton, and other things hitherto thrown away; also a glue for curing the said leather paper. Dec. 31, last past; March 12, 25 Geo. 2, 1752.

George West, of the city of London, surgeon: specification for "A peculiar composition which gives immediate ease in all diseases in the breast, called [by the Specifier] West's Pectoral Elixir." Jan. 1, 25 Geo. 2; March 13, 1752.

John Baynes, of King-street, in the parish of St. George, Bloomsbury, carpenter: specification for "A new method of making sash frames, which, by concealing the line and pulley, will be a great ornament to the better sort of buildings, and the sashes will not require so much liberty to slide up and down, or be so liable to be out of repair, as those now in use;" also preventing their making a noise in windy weather, and effectually excluding fog, wind, &c. A parchment schedule of drawings describing the invention is attached. Feb. 25, 25 Geo. 2; May 2, 1752.

Edward Coleman, of the parish of Lambeth (Surry), mariner: specification for "A machine which works by wind, water, or horse, in a quite new manner from anything of the kind, and will do more work with less expense," for draining lands, supplying towns with water, preventing the spreading of fire, dredging, grinding, turning, &c.; and likewise for keeping ships off a lee shore. Feb. 11, 25 Geo. 2; May 8, 1752.

Timothy Lightoler, of Warwick (Warwick), carver: specification for "A machine for the cutting of files." April 9, last past; July 28, 26 Geo. 2, 1752.

James Jackson, of the city of London, chemist: specification, pursuant to patent, granted to Joseph Collett, practitioner in physic, and the said *James Jackson*, for a medicine called "Oleum Anodinum, or British Balsam of Health," for the cure of gouty nodes and tumours, rheumatic and sciatic pains, fistulas, ulcers, the evil, leprosy, bruises, sprains, dropsy, stone, gravel, sterility, impotency, and consumptions, and other disorders of the lungs. July 3, 26 Geo. 2; October 18, 1752.

John Suxpeach, of the parish of St. Dunstan, Stepney (Middlesex), schoolmaster: specification for an instrument to be called "the Catholicorganon, or Universal Sliding Foot Rule," consisting of a stock that contains an octagonal slide, a telescope and two thin slides, each slide containing a brass tongue, that form a quadrant of great use in the practice of arithmetic, geometry, mensuration, gauging, trigonometry, navigation, dialling, astronomy, and all branches of mathematics. Exclusive of the lines on the quadrant, and the perpetual almanack, this instrument contains 86 lines, each answering a separate and distinct purpose, fully explained in the specification. Feb. 19, 26 Geo. 2; March 29, 1753.

Isaac Wilkinson, of Wilson-house, in the parish of Cartmell (Lancashire), gentleman: specification for "a new sort of cast metallic rolls for the crushing, flattening, bruising, or grinding of malt, oats, beans, or any kind of grain, and also for crushing, bruising, or grinding of sugar canes." A parchment schedule of drawings is attached. Jan. 24, 26 Geo. 2; March 20, 1753.

Radcliffe Green, of Wakefield (York), merchant: specification for "an art and method of dyeing and staining leather" in greater perfection than what is practised in Portugal or Barbary. March 30, 26 Geo. 2; May 5, 1753.

Richard Liddell, late of the town of Newcastle-upon-Tyne, but now of the city of London, master and mariner: specification for a new sort of machines, or vessels, for the removal of earth, ballast, sand, rubbish, rock, stone, or any other kind of matter that may be a nuisance to any port, river, &c. April 12, 26 Geo. 2; July 6, 1753.

Thomas Craven, of Scarborough (York), plumber: specification for "a new inven-

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tion of a pair of pumps, the barrels whereof are made of lead or brass, for the use of merchants' ships or colliers." A parchment schedule of drawings of the invention is attached. March 29, 26 Geo. 2; July 2, 1753.

Kersey Mole, of the parish of St. Matthew, Bethnal Green (Middlesex), turner: specification for "a new method of bleaching, whitening, and beautifying of hatts, comcommonly called Leghorn hats and other hatts, and the platts whereof the same are made, and also sundry other goods made either of straw, chips, cane, or other materials," &c., and restoring the same when stained, &c. April 10, 26 Geo. 2; July 24, 1753.

Louis Florent de Lannoij de Villers, of Cushion-court, in the parish of St. Peter Poor, in the city of London, esq.: specification for "a new method of making gun carriages of cast iron." A parchment schedule of drawings of the invention is attached, entitled, "plan of the cast iron rampart's carriages with three wheels, for the use and better defence of the several fortified colonies belonging to the Crown and East India Company of England." May 30, 26 Geo. 2; Aug. 20, 1753.

William Wright, of Baldock, in the county of Hertford, surgeon: specification for "a cordial mixture for women in labour." The materials are not specified. Aug. 1, last past; Sept. 12, 1753.

William Johnson, of Rotherhithe (Surry), brazier: specification for "double and single kettles, furnaces, and boilers made of wrought iron plate," to be used in the navy (instead of the copper ones, which have been found pernicious to health), and with which the Commissioners of the Admiralty have directed the navy to be supplied. Jan. 31, 27 Geo. 2; May 8, 1754, 27 Geo. 2.

Kemp Bowman, of the parish of St. Mary, Rotherhithe (Surry), gentleman, and *William Catherwood*, of the parish of St. Luke (Middlesex), apothecary and surgeon: specification for "a method entirely new of making salt from sea-water, by applying and adapting a certain machine not hitherto used for that purpose, and which machine is also so altered and contrived as thereby to extract and draw off spirits in a shorter time than yet practised." Feb. 21, 27 Geo. 2; June 17, 1754.

James Taylor, of Ashton-under-Line (Lancashire), clockmaker: specification for "an engine to be worked either by men, horses, wind, or water, for spinning of cotton wool into yarn," which will spin more and better cotton yarn, and lay the harle or staple of the wool more straight and close than any yarn yet produced. July 3; July 12, 28 Geo. 2, 1754.

John Lewis, of Plymouth (Devon), merchant: specification for "a new method of preparing from the glutinous juices of the American pitch pine tree a varnish of pine for paying ships' sides and masts, and for preventing timber buildings from the ill effect of the weather and from decay." Involving a peculiar apparatus and process. May 21, 27 Geo. 2; Sept. 11, 1754.

George Bowser, late of the parish of St. Luke (Middlesex), but now of the parish of Allhallows the Great, London, imbosser: specification for "an art or mistery of imbossing, printing, or staining callimancoes, and also a further valuable and great improvement in the imbossing trade by shading the colours on all sorts of woollen goods." July 3, last past; Oct. 14, 1754, 28 Geo. 2.

Joseph Collett, of the city of London; practitioner in physick: specification for "the Oleum Vitæ, or ladies' nervous and cordial drops, for the cure of nervous complaints, weakness, or contraction of the nervous muscles, lowness or dejection of spirits, vapours, historicks, convulsions, tremblings, and palpitation of heart." Dec. 2, 28 Geo. 2; Jan. 4, 1755.

William Daniell the Younger, of Yeovill (Somerset), glover: specification for a machine, to be worked by the ordinary motive powers, "for the dressing, winnowing, and cleansing of flax, and rendering the same fit for the manufacturer's use." Jan. 23, 28 Geo. 2; March 12, 1755.

Stephen Wright, of North Shields (Northumberland), master and mariner: specification for "a windlass, for the more easy weighing a ship's anchor at sea, which is worked with as much ease by four men as the windlass now in use can be by seven. Also a new invented machine, or wheel, for the more easy working of ship's pumps, whereby as much water may be raised by two men in the same space of time as is now done by the labour of four men with the common pumps." A paper schedule of drawings of the invention is attached. April 2, 28 Geo. 2; July 1, 1755.

Charles Frederick Weisenthal, of the city of London, merchant: specification for "working fine thread in needlework, after the manner of Dresden needlework, and erecting a manufacture of that sort in this kingdom," so as to enable poor girls of eight years old to maintain themselves without being burdensome to the parishes. June 24, 29 Geo. 2; Sept. 20, 1755.

Joachim Andreas Bahre, of the parish of St. James, within the liberty of Westminster (Middlesex), limner: specification for a method, by a certain liquid composition, made

and invented by the patentee, of printing and painting paper, silk, cloth, and canvas, in gold, silver, and brocade colours, which for beauty of colour excels anything of the kind yet made; will neither wash out, fade, or tarnish; will be of great use in making paper, silk, cloth, canvas, and other hangings and furniture, and can be sold almost as cheaply as the middling sort of paper hangings. July 22, 29 Geo. 2; Nov. 20, 1755.

Robert Walker, of the parish of St. Sepulchre, London, dealer in medicines: specification for "a medicine called 'Jesuits' Drops,' which is not only an effectual remedy for the certain disease, and is likewise a certain remedy for purifying the blood in all scorbutic humours." Oct. 29, 29 Geo. 2; Dec. 3, 1755.

(To be continued.)

NOTES AND NOTICES.

A new planet, it is said, has lately been discovered. This is not correct, the planet is as "old as the hills."—*Brother Jonathan.*

New Blowing Machine.—M. Heinrich Beinhauer, smelting factor, of Sonnbrau, near Elberfeld, in Rhenish Prussia, is stated to have invented a new blowing machine which gives a constant pressure, as indicated by the anemometer, and requires no regulator whatever. The blast produced by it is sufficient to pervade the column of a smelting furnace, with equal intensity, at all points and times. A machine of this kind, measuring 11 ft. 6 in., by 22 ft. 9 in., with a pressure of 40 ozs. on the square inch, and a horse power of 70, will furnish 6028·8 cubic feet of wind per minute, and after that rate for smaller dimensions.

Taylor's Marine Camels.—Another experiment was tried with these camels in our waters yesterday, on which occasion a vessel of the largest class was taken over a bar which she could not possibly have passed in any other manner. The inventor has followed the sea from boyhood, and the dangers to which he has been exposed, for the want of an instrument of this kind, together with the existing necessities in the particular of our naval force in the Mexican waters, first gave him the idea of an India Rubber Camel, and it is gratifying to know that the best judges have pronounced it an invaluable invention. The officers of the American Institute were so much pleased with it, that they have taken the pains to publish a full report, wherein they recommend it to the public in the strongest language. Not only can these camels be used to lighten vessels over sand bars, and to get off those that may have been stranded, but by being inflated and placed in the hold of a ship, they will keep the heaviest craft from sinking, and thereby be effectual in preserving life as well as property. These camels will, undoubtedly, be the most gladly welcomed by the sailors and shipping merchants of the great lakes, where sand bars are so abundant and dangerous.—*N. Y. Eve. Post.*

Fall of the Monster Chimney at Wigan.—The chimney, which has been completed for only a few months, was commenced by Mr. Dobb nearly four years ago, close to the lands of the Leeds and Liverpool Canal, at the termination of his extensive chemical works. Its progress since that time has been gradual during the summer months, but its progress has been necessarily stayed for several months of each winter,—when its part completion gave indications of its future greatness. Its completion was effected a few months ago, when it had reached the great height of upwards of 400 feet, or about 134 yards, and the event was duly celebrated. Shortly, however, after this was done an indentation of one side near the top was observed, and which was watched daily, when, after a further lapse of time, a very apparent deviation from the perpendicular had taken place, and the base slightly parted from the side of the excavation. A further inclination being observed, the advice of Mr. Fairbairn, civil engineer, of Manchester, was obtained, and we believe he recommended a portion of the top being taken down, and the work was consequently commenced, and continued until the day of its fall, when we believe a person was up the building; at this time about 28 yards had been taken off. For some time past a further sinking of the base has been observed, and greater fears were entertained for its safety, and a series of stays were being constructed to place round it. But all the measures were without avail. It fell on Thursday afternoon last, across the canal, and extends for the length of a field beyond it.—*Manchester Courier.*

LIST OF ENGLISH PATENTS GRANTED BETWEEN JAN. 21, AND JAN. 28, 1847.

William Breynton, of the Inner Temple, London, Esq., for certain improvements in rotatory engines. Jan. 21; six months.

Francis Preston, of Ardwick, near Manchester, spindle maker, for certain improvements in machinery or apparatus to be used in the preparation of cotton and other fibrous substances for spinning. Jan. 23; six months.

Frederick William Jowett, of Burton-upon-Trent, Stafford, engineer, for certain improvements in telegraphic communications. January 23; six months.

Clemence Augustus Kurtz, of Manchester, Lancaster, manufacturing chemist, for a new manufacture of a certain colouring matter to be used in the dyeing or in the printing of woollen, cotton, silk, and other fabrics. January 26; six months.

Richard Walker, of Rochdale, Lancaster, cotton spinner, for certain improvements in the apparatus for the manufacture of gas for illumination, which said improvements are also applicable to the manufacture of other products of distillation. January 26; six months.

William Phillips Parker, of 48, Lime-street, London, gentleman, for improvements in bell machinery. (Being a communication.) January 28; six months.

Thomas Webster Rammell, of 12, Dorset-place, Dorset-square, Middlesex, civil engineer, for improvements in the preparation and application of cork for linings and other useful purposes. January 28; six months.

Elizabeth Oudinot Lutel, of Addle-street, London, for producing a certain texture, elastic in some parts. (Being a communication.) January 28; six months.

James Taylor, of Furnival's Inn, Middlesex, gentleman, for an improved apparatus for boring into the earth. (Being a communication.) January 28; six months.

Peter Armand Lecomte de Fontainemoreau, of 15, New Broad street, London, for certain improvements in the process and apparatus for treating fatty bodies and the matters producing them, such process and apparatus being equally applicable to the treating several other substances, and also for the process and apparatus necessary for the useful application of all those products. January 28; six months.

John Law, of York-place, Portman-square, Middlesex, gentleman, for improvements in yarns, and the machinery by which the same are manufactured. (Being a communication.) January 28; six months.

John Braithwaite, of 39, Bedford-square, Middlesex, civil engineer, for certain improvements in heating, lighting, and ventilating. January 28; six months.

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LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Dec. 24	904	James Parker and Charles Page	No. 10, Bacon-street, Bethnal-green	Cane rib for parasols.
,,	905	Brown and Redpath	Commercial-road, Limehouse	Improved portable forge for ships, &c.
26	906	John Brown and Son	Newcastle-on-Tyne	Chamber looking-glass.
1847 Jan. 4.	907	Pearson and Winkle	Sheffield	Razor blade.
,,	908	William Higgs	48, Newington-place, Kennington	Chamber candlestick.
5	909	James Jones, jun., and Christian William M'Neil	Bow-street; Heathfield, Wandsworth	Sinumbra gas lamp.
,,	910	John M'Pherson	No. 4, Melbourne-place, Edinburgh	Improvement on lamps for the inside of railway carriages and other useful purposes.
,,	911	Josiah Wilkinson	9, Sherrard-street, Golden-sq.	Coat cape, or wrapper.
,,	912	James Barber	112, High Holborn	Double safety bolt.
,,	913	Edward Joseph Weston	Holborn	Wearing apparel.
6	914	William Franks and William Paul	12, Bridgewater-square; Leather-lane, Holborn	National economic gas-lamp.
,,	915	William Dunbibin	92 and 96, Great Crosshall-street, Liverpool	Bagatelle nouvelle table.
7	916	Marcus Davis	11, Upper-terrace, Islington	Instrument for measuring distances, or geometer.
9	917	John Margetson	Cheapside	Protector label.
11	918	Charles Symons	1, Princes-street, Fitzroy-square	Independent bed-room fire-escape.
12	919	William Lewis	Frampton-on-Severn, Gloucestershire	Waistcoat.
13	920	George Webb	Wood-street, City	Protection rouche tray.
15	921	Robert Boyd	21, Fishergate-st., Preston, Lancashire, Tailor	Coat (the Bernous.)
18	922	Benjamin Nickels	York-street, Lambeth	Universal delineator for the use of artists, &c.
19	923	John Hunter	16, Maddox-street, Hanover-sq., Tailor.	Supertunic.
20	924	Edward Thomas Birch	Manchester, Shuttle-maker	Improved shuttle for weaving.
,,	925	James Startin	3, Finsbury-place, Finsbury-sq.	Pneumatic inhaler.
,,	926	W. and J. Galloway	Manchester, Engineers	Internal flues in a steam-engine boiler.
21	927	Harcourt Brothers	Bristol-street, Birmingham	Door lock spindle.
22	928	Parker, Field, & Sons	233, High Holborn	Cartridge belt.
25	929	Hannah Smith	Bedford-street, Halifax	Stiffener.
,,	930	Joseph Shires	Newton-street, Manchester	Iron shoe or tip.
,,	931	Gabriel Davis	Leeds, Optician	Graduated medical galvanic machine.
,,	932	Jacob David Davis	No. 14, St. Mary Axe, in the City of London	Coat.
26	933	T. W. Atlee and Co.	Birmingham	Ether inhaler.
,,	934	Charles Mathew Pace	49, King-street, Westminster	Cornopean.
27	935	William Hammond Turner, James and Henry Turner	Manchester, Button Manufacturers	Hook and Eye.
,,	936	Richard Clark	447, Strand	Comet gas-burner.
28	937	James Freeman	No. 7, Little Chester-street, Grosvenor-place, Pimlico, Whitesmith	Chimney cowl.
,,	938	R. W. Winfield	Birmingham	Improved slide for gas-lamps and chandeliers.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 23RD OF DEC. 1846, TO THE 21ST OF JANUARY, 1847.

Eugene Bazile, of Rouen, France, manufacturer, for improvements in obtaining heat during the manufacturing of coke, and applying such heat to various purposes. (Being a communication from abroad.) December 23.

James Napier, of Shacklewell, Middlesex, operative chemist, for improvements in smelting copper ores. December 23.

George Fergusson Wilson, of Belmont, Vauxhall, Surrey, gent., and John Jackson, of Southville Wandsworth road, Surrey, gent., for improvements in the process of, and apparatus for treating fatty and oily matters, and manufacturing candles and night lights. December 24.

John M'Pherson, mill manager, Greenhead, of Glasgow, Scotland, for certain improvements in weaving. December 28.

William Little, of 198, Strand, publisher of the

Illustrated London News, for improvements in machinery for printing. December 30.

Henry Mapple, of Child's-hill, Hendon, Middlesex, machinist, for improvements in apparatus for transmitting electricity between distant places, and in electric telegraphs. December 30.

Charles Payne, of Witehall-wharf, Cannon-row, Westminster, gent., for improvements in preserving vegetable matters. December 30.

David Davies of Wigmore-street, Cavendish-square, Middlesex, coach-maker, for certain improvements in steps for carriages and other purposes. (Being a communication from abroad.) December 30.

Adrien Chenst, of Clichy-la-Garreue, near Paris, France, formerly a student in the Royal School of Mines in France, for certain improvements in the treatment of metallic oxides and their compounds, and in apparatus for the same. December 31.

Stephen R. Parkhurst, of Leeds, York, manufacturer, for improvements in carding wool, cotton, and other fibrous materials. December 31.

Thomas Morton Jones, of Birmingham, gent., for improvements in heating liquids and aëriform bodies. December 31.

Alexander Bain, of 11, Hanover-street, Edinburgh, electrical engineer, for certain improvements in transmitting and receiving electrical telegraph communications, and in apparatus connected therewith. January 5.

John Watson, of Glasgow, manager to Messrs. Gilmour and Kerr, power-loom cloth manufacturers, for improvements in weaving by jacquard looms by power. January 5.

William Air Foster, leather merchant and bootmaker, Glasgow, Lanark, for an improved mode of making belts, (for driving machinery, and for other like purposes,) traces, reins and other articles of leather, pelt or parchment, and also certain apparatus or machinery therein applicable. Jan. 7.

NOTICES TO CORRESPONDENTS.

College for Civil Engineers.—*We received, on the eve of publication, the letter of Colonel Jackson, which we insert in another part of this day's Magazine. Justice to the writer seems to us to call for its immediate publication, though time is wanting to enable us to add those observations which seem equally called for in justice to ourselves. Next week we shall have a few words to say upon it; and meanwhile we must request our readers to suspend their judgment on the points at issue.*

The continuation of "Justice's" letter on the "Screw and Paddle" in our next.

Communications received from N. B. R.—Mr. E. Jackson.—An American.—F. F.—A Shipbuilder.—S.—M. H.

Advertisements.

To Railway Companies, Coke Burners, Ironfounders, &c.

CHURCH'S PATENT IMPROVEMENTS in the Manufacture of Coke and in the construction of Coking Ovens. Licenses to work under this patent may now be obtained on application to Messrs. Theobald and Church, Gas Works, Colchester, Essex.

No Brewing Utensils Required.

THE PATENT CONCENTRATED MALT and HOP EXTRACT enables private individuals to make fine Home-brewed Ale or Porter, without employing any Brewing Utensils. It has only to be dissolved in hot water and fermented. Sold in Jars for samples and other purposes, at 1s. and 1s. 6d.; and in Bottles for brewing Nine to Eighteen Gallons, and upwards, of Ale, at 6s. 6d. and 12s. 6d. each, by the British National Malt Extract Company, 7, Nicholas-lane, Lombard-street; Petty, Wood, and Co., 12, King William-street, City; Wix and Sons, 22, Leadenhall-street; Batty and Co., 15, Finsbury Pavement; Decastro and Peach, 65, Piccadilly; Hockin and Co., 38, Duke-street, Manchester-square, London: Ferris and Scone, Bristol; P. Harris, Digbeth, Birmingham; T. Standring, Piccadilly, Manchester; J. H. and S. Johnson, Church-street, Liverpool; H. C. Baildon, Edinburgh; George Duff, 4, Eden Quay, Dublin; and Oilmen and Grocers generally.

Also, just published, and may be had Gratis,

NATIONAL BREWING; a Guide to the Use of Concentrated Malt and Hop Extract, for Brewing and Wine Making; to which is added Medical Opinions, relative to the virtues of Malt and Hops.

London: DIRCKS and Co., 7, Nicholas-lane, Lombard-street.

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The Compressed Air-Engine System.	Descriptive and Analytical Geometry.
American Opinions on Marine Steam-engines.	Rectification of the Circle.
The Gun Cotton.	Mensuration of Earth-work.
The Gutta Percha Manufactures.	Practical Methods of Forming Logarithms.
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"The *Mechanics' Magazine* has conferred lasting advantages on the Arts and Manufactures of the Country."—*Report of Select Committee of the House of Commons on the Arts of Design.*

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A Challenge to the World!!!

THE NATIONAL ECONOMIC GAS BURNER.

Registered according to Act of Parliament.

To demonstrate the superior advantages which this new Burner possesses over ARGAND's and all other Burners, it is necessary that we explain in what respect the latter are deficient.

It will, no doubt, be admitted, that, in consequence of ARGAND's Burner being a uniform cylinder, only the external particles of the column of air which ascend towards the place of combustion, actually combine with the ignited Gas; it is evident, therefore, the myriads of globules, or those imperceptible atoms of carbon or smoke which constitute the centre of this column, are carried with a velocity peculiar to a cylindrical body of air, beyond the vicinity of the combustion, and thereby escape without having been appropriated. It was established by SIR HUMPHRY DAVY while engaged in the invention of the Miner's Safety Lamp, that an unrestricted supply of atmospheric air, though it increased the heat, materially diminished the light yielded by coal gas. In all the gas burners the air is admitted, without sufficient limitation and regulation, both to the inner and outer surface of the flame.

Now in this newly-invented Burner, these great defects are obviated by the following adjustments:— A solid conical button is inserted into the inner air-channel, at a certain height from the top of the burner, which arrests and restricts the supply of air, and at the same time causes it to be diffused equally and regularly over the inner surface of the flame. The outer current is adjusted by means of a conical glass chimney. By this combination, the gas-flame is placed between two streams of atmospheric air, nicely regulated to a proper amount, and distributed in the direction that is most highly favourable to complete combustion.

The Burner contains but one row of jet holes, not two and three rows, as some recently constructed burners do, which shows the unscientific principles of their arrangement; for how is it possible for the atmospheric air to get into the centre of the gas? It must be granted by every chemist that that is impossible. Then, how is it possible for the gas to be consumed without a due admixture of oxygen? and there are no hollow stems nor hollow buttons, and mark, no fire holes, which are preposterous.

But there is another important arrangement in this new Burner, whereby (as is proved by the evidence of some of the first Engineers and Chemists of the day,) artificial light is thus produced, in greater quantities and of a better quality, than by any means heretofore known, and *at a saving of from* 30 *to* 40 *per cent.*

The merits of this invention, the result of protracted study and perseverance, and great expense, are to be found in the production of a Burner which produces *no shadow*, and consequently renders profitably available as much of the light as possible. The combustion being perfect, there is *no deposit of soot*, therefore no filthy black ceilings, *and no smell.* In proof of the extraordinary pureness of the light that it produces, it may be mentioned, *that shades and tints of colours may be distinguished by night as perfectly as by day*,—an effect that has hitherto been in vain desired.

To be seen Burning from 11 *till* 8, *at*
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BY J. F. HEATHER, of the Royal Military Academy, late Scholar of St. Peter's College, Cambridge. A Prospectus, and plan of publication, will be forwarded, upon application to Mr. Truscott, printer, Nelson-square, London; or to the Author, at the Royal Military Academy, Woolwich.

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CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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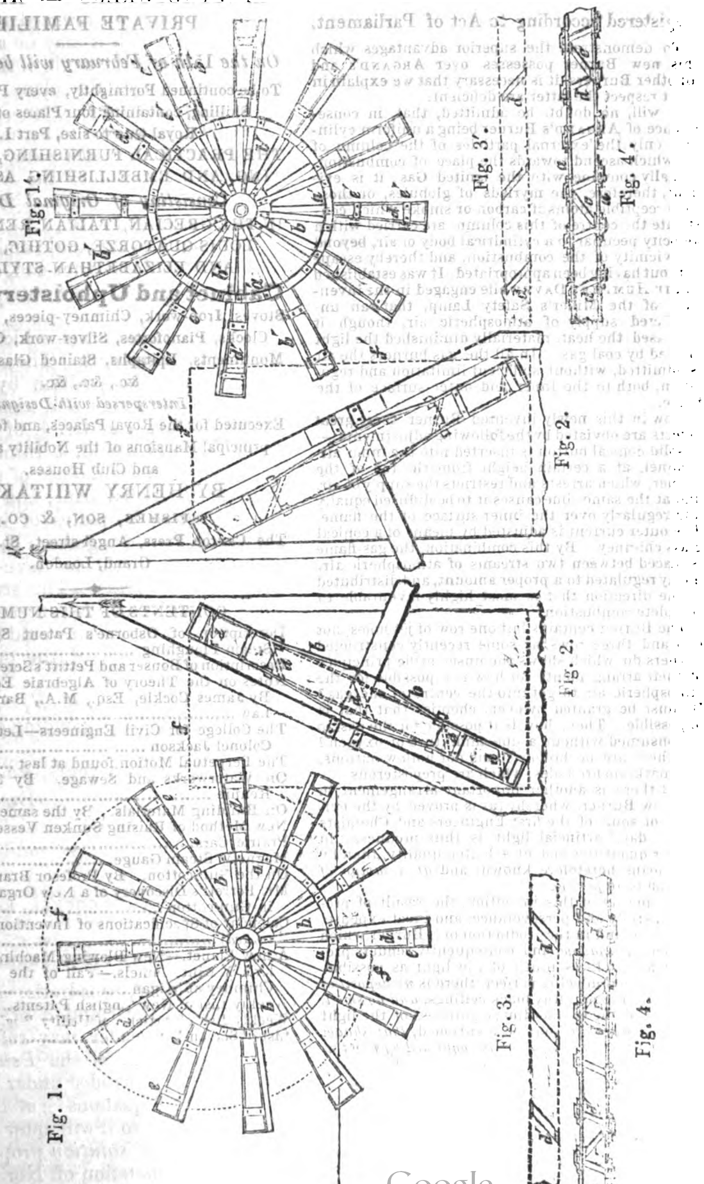
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1226.] SATURDAY, FEBRUARY 6. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

BIRAM'S OBLIQUE PROPELLER—MODIFICATION.



BIRAM'S OBLIQUE PROPELLER—MODIFICATION.

Dear Sir,—If you think the accompanying sketch of a modification of my propeller worthy a place in your magazine, I shall feel obliged by your inserting it.

In my specification (see *Mech. Mag.*, vol. xxxvii., p. 322,) I describe propellers fixed at the stern and at the sides of vessels; but I do not claim for the position, but merely for the shape of the floats.

The power may be applied by means of bevel gear attached to a shaft in the position of the ordinary paddle-wheel shaft, by which motion could be communicated to the shaft of these paddles, the whole of the machinery being placed as at present, or in any other convenient way. Indeed, there could be no practical difficulty in applying the power, which admits of a variety of arrangements.

I have by me two models of wheels, one with 12 floats, of the proportion shown in the engravings, and the other with 15, one-third less in width, the action of both of which upon the water appears to me exceedingly satisfactory.

When the wheel is in motion, the water is thrown off from it obliquely, which, as it is fixed, would be to the rear of the vessel's path, as shown by the dotted lines fig. 2; each float, as it revolves, and the vessel progresses, constantly acting in undisturbed water. The water being thrown off *obliquely*, and not *lifted* by the floats, admits of the wheel being submerged deeper in the water, whereby as great an area of propelling surface is obtained as in the ordinary paddle, whilst a much greater resistance is offered by the water to the acting floats, in consequence of the greater immersion. The entrance and emerging of the floats from the water is as near a feather-edge as possible.

Fig. 1 shows a side elevation of the larboard paddle-wheel.

Fig. 2, a plan of the same wheel, and of its position with regard to the side of a vessel to which it may be attached.

Fig. 3 shows the angle of the periphery of the floats with the plane of rotation, and their distance from each other. These will be shown to be nearly at right angles to the vessel's path, offering the greatest resistance to the water during the time of action, as shown by the lines, *d d d*, on fig. 2¹.

Fig. 4 shows the angle and distance of the floats at their inner end, corresponding in position with the outer edge of the rings *a a*, fig. 1.

b b b are radial arms, which may be of any requisite strength. They are retained in their relative position by being attached to the rings *a a*, assisted by the diagonal stays *c c*, fig. 4, of which four in each wheel would, I think, be sufficient. The floats *d d* are of wood, fitted between the radial arms, and retained in their position by plates of iron, *e e*, on each side, bolted together; the ends project on, and might be dove-tailed into, the two radial arms. The strong dotted lines *f f*, fig. 1 and 2, represent the outline of the space which would be occupied by a paddle-wheel of the ordinary description.

Figs. 1′, 2′, 3′, 4′, *a′*, *b′*, *c′*, *d′*, *e*, and *f′* describe the corresponding parts of the larboard paddle.

I am, Sir, yours, &c.,

BEN. BIRAM.

Wentworth, Jan. 20, 1847.

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

No. 2.* BIQUADRATIC EQUATIONS—EQUATIONS OF THE FIFTH DEGREE.

By a change of my original plan, I shall defer the further consideration of cubic, and proceed to the subject of biquadratic equations.

The solution of a biquadratic equation, which I shall select as the best adapted for placing this class in the same point of view as that in which we have already regarded linear, quadratic, and cubic equations, is the solution of FERRARI, for which the reader may refer to page 340 of vol. xxiv. of the *Penny Cyclopædia*. It is included under the article "Theory of Equations" of that work; and a reference to it will show the reader that the *type of solution* proper to it is, retaining the notation of No. 1 of these papers (*ante*, p. 104,) and writing p for v,

* No. 1 will be found, *ante*, p. 103.

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$$F''(x^2+p)=F''(\mathrm{p}x+\mathrm{P}),$$

p and P being functions of p, and p *not* being (originally) a known quantity. In this solution, the co-efficient of the second term of the given biquadratic is supposed to be zero. So that the type of solution of a perfect biquadratic involving one unknown quantity is

$$F''\{(x+a)^2+p\}=F''\{\mathrm{p}(x+a)+\mathrm{P}\}.$$

On inspecting the last two equations, the reader will remark the absence of the symbol F'''', which, according to our notation would denote the operation of *raising to the fourth power*. He will doubtless observe, that while the types of solution of linear quadratic and cubic equations may be expressed by means of F followed by as many accents as there are degrees of x in the given equation, that of biquadratic equations is expressed by means of F'' only. He will, thence, possibly be led to ask, whether the above comprise *all* the types of solution of biquadratic equations; and whether there be not some type of solution involving F''''?

If by this be meant a type of solution *essentially* different from the foregoing, the answer must be in the negative. In fact, let us suppose for a moment that

$$F''''(x+a+p)=F''''(\mathrm{P}),$$

is the type of solution of biquadratic equations, a, p, and P, having the same meanings as heretofore. Then, on this supposition, we shall be able to express the general root of a biquadratic in irreducible biquadratic surds, a consequence which is inadmissible, (see page 41 of MURPHY's *Treatise on the Theory of Algebraical Equations*, at the close of art. 31). That there is no other type substantially differing from the first two of those above given, is also laid down by Sir W. R. Hamilton at the close of article [20] of his paper on the argument of ABEL, for which see vol. xviii. of the *Transactions of the Royal Irish Academy*, p. 237 of the division "Science."

All equations may be distributed under one or other of the three following classes: I. SOLVIBLE equations; II. Equations (algebraically) INSOLVIBLE; and III. IMPOSSIBLE equations. The first class it is needless to illustrate; the second may find an exemplification in the general equation of the fifth degree; and the third in a species of equation noticed by HORNER at pp. 43—50 of vol. viii. of s. iii. of the *Philosophical Magazine*.*

The genus of "insolvible" equations may contain two distinct species, the one comprising equations as yet algebraically *unsolved*, the other embracing equations whose algebraic solution is impossible. The last species of this second class of equations must not, by any means, be confounded with the third of the before-mentioned classes. It is, indeed, perhaps possible to show that the hypothesis of the existence of algebraic solutions of certain insolvible equations leads to the supposition of the possibility of solving an "impossible" equation, as I have elsewhere suggested (*Mech. Mag.* vol. xliv., p. 406, col. 1), but the classes themselves must not be confused; and in this classification it must be borne in mind that I am alluding to equations containing only one unknown quantity. But the impossibility of a problem may be indicated not only by an impossible equation, but by a system of INCONGRUOUS equations (such, for instance, as $x=1$, $x=2$, which when the x's are identical, gives $1=2$,) and by other circumstances which I shall not stop to mention here.

Now, in the fact that we possess complete algebraic solutions of a biquadratic equation — solutions which are themselves capable of being referred to general principles—there are, probably, some who would be inclined to find an excuse, if not for considering the subject of those equations as exhausted, at least for regarding all further inquiries respecting them as useless. But the connections that exist, or, at all events, the analogies that may be traced, between certain propositions relating to biquadratics and others, respecting equations of the higher degrees, give the discussion of the first mentioned equations an interest greater than at first sight we should be disposed to attribute to it.

We have already seen that these equations, from the first, present rather an anomalous aspect. With reference to the use of quadratic surds, they may be ranged in the class of *solvible* equations; but if we exclude other than surds of the same degree as the given equation (*i.e.*, other than biquadratic surds), they must be excluded from that class. As it has occurred to me that this characteristic

* See Young's *Theory and Solution of Algebraical Equations*, second edition (London, 1843), pp. 26 and 40.

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may, possibly, be applied to a purpose of some importance—a purpose which I shall explain in this paper—and as I have already proceeded as far with the theory of biquadratics as with those of equations of lower degrees, I shall reserve my remaining observations upon these equations exclusively, and briefly advert to the first four degrees generally, so far as we have yet considered their theory.

The results of the present and the preceding Note (*ante*, p. 103), so far as they relate to this subject, may be stated as follows:—linear equations are solved by *reduction*, quadratics by *reduction* and *evolution*, cubics by *reduction*, *evolution*, and the *subsidiary* method, and biquadratics without the introduction of other methods and processes than those employed in solving cubics.

By the term SUBSIDIARY method, I wish to be understood as expressing something different from the simple INDETERMINATE method. In the latter we substitute two (or introduce more unknown quantities), instead of x in the given equation. And this being done, we can vary, in some cases, almost indefinitely the conditions to which we may subject the new unknowns. An instance of this indeterminateness will be seen* in the solution of a cubic by the method known by the name of CARDAN. But in one of my solutions of a cubic† (which forms the basis of our illustration of the type of solution of those equations in their most general form,) the *subsidiary* quantity p is introduced for a particular purpose only, and is used to satisfy one particular and determinate equation; and the same thing may be remarked of the quantity v, which occurs in the biquadratic solved by the method of FERRARI, (see *Penny Cyclopædia*,—place before cited.)

An ardent and speculative mind, observing the increase of complexity of the type of solution in ascending from linear to cubic equations, would, perhaps, be disposed at once to infer the non-existence of any such type, for biquadratics, as that last above given. And that inference would be correct. Such a mind would probably carry the argument further, and pronounce *à fortiori* that equations of the fifth degree had no such type of solution. And, 5 being a prime number, we cannot resort to any such modification of our type as that to which we had recourse in the case of biquadratic equations. I say, then, that if the above results comprised all that were known (though known under many various forms) of the theory of equations, those results would probably suggest the notion of the non-existence of any type of solution of general equations of the fifth degree, and the consequent impossibility of obtaining their solution.

And there appears to have been at no time much backwardness in placing equations in the second rather than in the first species of *insolvible* problems,—in attributing their insolvibility to the natural IMPOSSIBILITY of the thing sought, rather than to the inefficiency of the method of conducting the search. On referring to the article CARDAN, in the *Penny Cyclopædia*, we see that his restless and inquisitive genius made a mistaken interpretation of a remark of LUCAS DI BORGO a sufficient reason for believing in the absolute impossibility of solving cubic equations.‡

With respect, however, to the equation of the fifth degree, an alleged *demonstration* of its absolute insolvibility was given by the celebrated ABEL, and will be found at pp. 5—24 of the *Oeuvres Complètes*, &c., tom 1er., (Christiania, 1839.) This supposed demonstration is discussed by Mr. Jerrard in (xxxiv and xxxv, pp. 110—116 of) his *Mathematical Researches*, who there pronounces it invalid. One of the defects to which Mr. Jerrard alludes, is that "the 120 values which he (ABEL) speaks of as belonging to *one* equation are in reality distributed among *four* equations.§"

* Barlow's *Tables* (first edition, London, 1814), Introduction, p. xxv.

† The solution may be shown to fall under the principle of LAGRANGE as follows. It results from my concluding formula, at p. 503, of vol. xxii. of the *Phil. Mag.*, s. iii., that, if x_1, x_2, and x_3 be the roots of the given cubic, and a, a^2, the unreal cube roots of unity,

$$x_1 = -p \times \frac{a}{3p} \ldots\ldots (1)$$

$$x_2 = -ap + \frac{a}{3ap} \ldots\ldots (2)$$

$$x_3 = -a^2p + \frac{a}{3a^2p} \ldots\ldots (3)$$

then $(1) + a^2\,(2) + a\,(3)$ gives us

$$x_1 + a^2x_2 + ax_3 = -3p,$$

a formula which falls within those of LAGRANGE and VANDERMONDE.—J. C.

‡ P. C. vol. vi., p. 286, col. 2.

§ *Math. Res.*, Supplement to Part III., p. 113.

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In the 18th vol. of the *Transactions of the Royal Irish Academy*, pp. 171—259, will be found a paper (to which a reference has been already made) on the argument of ABEL. After making some necessary modifications of that argument, the writer, Sir W. R. Hamilton, confirms the inference drawn by its author, and expresses an opinion adverse to the possibility of solving general equations of degrees higher than the fourth—an opinion to which he adheres in a paper on the researches of Badano, published in the succeeding (19th) volume of the *Transactions*, pp. 329—376 of the division "Science."

Still, to the inquiry, *Whether equations of the fifth degree admit of finite algebraic solution?* the answer must be, that that question is still open. The following remarks are made upon the argument above mentioned, by Dr. Peacock, in the concluding page of the last edition of his *Algebra*, (2nd vol., Camb., 1845).

"Its authors would appear to have omitted to notice the effect of equations of condition in limiting the multiple values of the final expression for the roots, a consideration which enters essentially into all speculations on the general solution of equations."

We are, then, even after Sir W. R. Hamilton's revision and amplification of the argument, justified in entertaining doubts as to its conclusiveness—so that, considering the failures of different proposed methods of solution, the state of the subject is best expressed in the words of a question proposed last year by the Dean of Ely, in the examination for Smith's prizes (see the *Cambridge Calendar* for 1846, p. 355, question 19.) That question concludes with requiring it to be shown "that it is contrary to probability that there should exist any formula for the general solution of an equation of a degree superior to the fourth."

My own researches on the subject I have alluded to in a previous volume of this work.* Mr. Jerrard has (*Phil. Mag.*, s. iii. vol. xxvi. page 545) proposed a method of solving equations of the fifth degree, which does not render the problem indeterminate. The discussion is very intricate, and not without its difficulties. (*Ib.* vol. xxviii. p. 63.) I would venture to suggest, with great diffidence, that some light would be thrown upon these difficulties by attempting to apply the same process to the reduction of the general biquadratic to the binomial form. Now, as this reduction cannot be effected, we shall, by watching the processes attentively, obtain an insight into the reason of their failure in the case of biquadratics. We must, then, in discussing Mr. Jerrard's last proposed method of solving equations of the fifth degree, scrutinize narrowly those steps of the process which correspond to the points at which our investigations fail in the case of biquadratics.

I have myself commenced such a discussion, substituting fourth for fifth roots of unity in Mr. Jerrard's group (a.) (for which see *Phil. Mag.*, s. iii. vol. xxvi. p. 546), making $u=0$, and leaving out the last equation of that group. I have thus, by making the necessary modifications in the processes of that work, obtained two equations corresponding to (b), (which will be found *ibid.* p. 549,) each equation involving two of the roots of the biquadratic. *One* of the roots of the given biquadratic is common to both these equations. But we may transform one of these equations of the new group corresponding to Mr. Jerrard's group (b.), in such a manner as that no root of the given biquadratic shall be common to both equations, but that *one*, and only one, of the fourth roots of unity shall enter into them, which same root will be similarly involved in both. I mention this, not that I am continuing the investigation, but merely to attract the attention of others to the subject, in the hope that they will be induced to pursue it.

If there be not much reason to hope for a successful result in the case of equations of the fifth degree, there certainly would appear to be no ground for absolute despair in the failure of a corresponding process as applied to biquadratic equations. There is one feature which may serve to illustrate the difference between the theory of equations of even and of odd degrees. Let n be the degree of a given equation, then, when n is even, the expression

$$\tfrac{1}{2}(n.\,n-1)$$

is not a multiple of n; but when n is odd, the above formula *is* a multiple of n. This, and similar circumstances, which would enter into our consideration in forming symmetric functions of the

* *Mech. Mag.*, vol. xliv. pp. 404—406.

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roots of an equation, may possibly offer some little encouragement to those who should be inclined to prosecute the subject.

In my next note I shall probably proceed to the consideration of the strictly indeterminate methods.

I am, Sir, yours, &c.,
JAMES COCKLE.

2, Church-yard-court, Temple,
January 30, 1847.

COLLEGE FOR CIVIL ENGINEERS.

The letter of Colonel Jackson, which we printed in our preceding number, calls for an incidental remark or two, which only want of time prevented us from appending to his letter, in the shape of a note. Another letter of still greater importance, from Mr. Cowie to a friend of our own, has been since placed in our hands by the gentleman to whom it was addressed, with permission to make any use of its contents we might think proper. We have every desire to place all matters on which we comment in the fairest light that appears to us consistent with the circumstances that come before us; and we should, therefore, have been glad had Colonel Hutchinson, Mr. Page, and others, of whom we have spoken, offered us such explanations as they deemed it advantageous to themselves to make. As they have not done so, we are entitled to enfer that our representations with respect to them are admitted to be essentially accurate. We, at any rate, shall always be glad to correct any oversight into which we might have been betrayed in our strictures, upon our being shown to be in error. We favour no man:—we fear no man:—we wish to mete out justice to every man.

We shall take the articles of Colonel Jackson's letter seriatim:

1. We never said that Colonel Jackson, "intrigued:" but how he can suppose that we have taken away his "good name," by stating that he "sought *remunerative* occupation," is best understood by himself. *We consider this no stigma upon any man.* We do not comprehend the "noble purpose" of which the gallant officer speaks; if either an improvement of his own finances, or some tantamount advantage was not expected to accrue from his connection with Mr. Horneman and his co-projectors. We have nowhere expressed the slightest doubt of the Colonel's "honesty," viewing his conduct as that of a man of business: but we must yet be allowed to express our doubts as to that philanthropic chivalry to which he makes such pretensions, which would take so much *unremunerated* trouble for the benefit of the projectors, or even of the public, which he professes to have done. Let us bring this to a clear understanding; viz., whether he intended to incur the labour and anxiety of the Resident Directorship, *without pay*. Nay, let him tell us whether, even up to the time of his resignation, his labours were wholly *gratuitous?* The Colonel is fond of "fancy views" of life and honour; and *disinterestedness* is a favourite pretension with military men, notwithstanding that they generally condescend to "accept pay" for all those civil offices into which they can manage to intrude themselves, We say, therefore, that we have not taken away the Colonel's "good name" by intimating that he was anxious for *remunerative employment:* but that we despise the absurd profession of a "noble purpose," (apart from what we consider to be every man's duty of doing the best that he *honestly* can for himself,) in connecting himself with Messrs. Horneman and Company.

2. To his paragraph respecting "countermining," we simply state that we refer to the agents and friends of Colonel Hutchinson in the Council.

3. It is sufficient to say, that we have coupled the names of the two gallant Colonels as *successive* Resident Directors: not as cotemporary ones. It is difficult to understand Colonel Jackson's logic, or even his mode of reading, when we see him confusing matters so distinctly separated, as we had kept all our remarks in reference to those two gentlemen. We believe Colonel Hutchinson had the benefit of Colonel Jackson's "scheme of study;" and our only reference to them conjointly (if conjointly, it can be called,) was in respect of the scheme of the one, and its working in the hands of the other. We are glad to learn that they could be respectively "civil" and "courteous" to each other under their respective relations.

4. We could not, till so informed (for we know as little as other people by *intuition*,) know that the "feeler" put forth in the *Artizan*, was not Colonel Jackson's own *antenna*. Whose soever

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it be, it evidently is a "feeler;" and it will be remarked, that our suggestions are equally important whoever may be the projector of a new college for engineering education; and they were made with the sole intention of leading to a more careful system of estimates than it has been customary to make with respect to proprietary schools.

5. The Colonel tells us we have "entirely misunderstood" his system of education. Perhaps we have: but it has not been for want of careful examination of it. We had not omitted to consult his paper in the *Surveyor, No. IX*, any more than his article in the *Artizan.* The general remark in the former place (page 199) is unobjectionable: but in his scheme for the employment of the time of the students, the subject is dropped *sub silentio.* We did not look at Colonel Jackson's general notions, but at his prescribed regulations for the management of the College; and we still think, that this is the proper criterion to apply in such a case.

With respect to his system being only a "slight modification" of that which has succeeded in other countries, it is scarcely necessary to express an opinion. All we have said is, that the system is "absurd and impracticable" come whence it may. We said this much more than six years ago: we repeated it recently: we hold the same opinion still. We hold it, too, let us tell Colonel Jackson, after having enjoyed infinitely better means of judging of all matters relating to education, than the Colonel can ever have had; and we hold them, we may add, after having had our eyes open and our minds alive to all the "phases" of instruction, for the greater part of half a century. We claim then, despite his dictum, a right to form an opinion on this subject, and to have some degree of respect, moreover, paid to our opinion by the mere amateur educationist.

Colonel Jackson wrongs us in supposing we are incapable of reversing our expressed opinion either of men or things. We are always most happy to be able to think better of men, or of men's productions, or of men's conduct, than circumstances may have sometimes led us to do. Of the Colonel himself we have freely expressed our opinion as an education-reformer: as a man and an officer, however oddly he may interpret our remarks, we have never spoken either respectfully or disrespectfully.

We cannot, indeed, understand by what strange process of mind, the Colonel has transformed our strictures on his *judgment* respecting a matter which to him was non-professional, into an imputation against his *personal honour and moral honesty.* To us it appears as indiscreet for a man to proclaim his own honour and integrity, when it has not been assailed, as for a woman to harangue the public upon her own exalted virtue. Self-laudation requires great delicacy; as people are often led to suspect, perhaps erroneously, the value of advertised virtues as well as advertised genius and advertised wares.

Indeed, but for his first intemperate and offensive letter, the information which he has himself been led to communicate, and the inquiries which his remarks have led us to make, his name would probably have never been once mentioned in our pages. In fact, our reference to the college was only incidental in the first place; and nothing was then further from our intention than any subsequent allusion to it,—except on the possible acquisition of some useful suggestions derivable from it for the details of professional study (vol. xliv. p. 220.) For all that has since appeared, those affected by it have only to thank Colonel Jackson.

As a proof in point, we now proceed to notice Mr. Cowie's letter. We do not publish the whole; for we claim to ourselves the right of judging whether he deserves the compliment we have paid him or not—and his estimate of himself, as is generally the case with able men, is a good deal below the mark. A sensible man, whatever may be his successes, is conscious of many failures; whilst a vain man is led to identify with his worst failures, a high degree of success! We admit, indeed, that the state of things as regards the council, which his letter explains, was calculated to lessen the irksomeness of the undertaking; and we hasten to correct a very important omission in our former strictures, by showing that the council is now composed of very different men from those who constituted it in by-gone days.

"I think it would be but fair to mention to the writer of the papers in the *Mech. Mag.* (if you can get it conveyed to him through your acquaintance with

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Mr. Robertson), that the members of the present council deserve the full credit of having brought about the respectable state in which the college now stands. They came forward jointly and fulfilled the chief part of the rash engagements entered into by the first promoters, without the concurrence of their responsible brethren. Those gentlemen were paid up in full all demands they had to make for their time and trouble in managing the college. Their places were then surrendered to the present members of the council, who bought the freehold estate on which the college stands.

"They also interfered on the late occasion of Mr. Page's retirement, and came to the conclusion that it was necessary to make one person responsible for the entire management, and to confer on him a corresponding authority. The stipulation was not proposed by me in the first instance, as the writer in the *Mech. Mag*. has inferred; but it formed a part of the conditions on which the council had resolved already.

"I should never have entertained the proposal of the council, unless there had been a clear and obvious path before me. I had several instances from the experience of my college friends whilst resident at the university, of the total impossibility of any man carrying on an educational establishment without complete discretionary power over all its details.

"It was the honourable, candid, and gentlemanly spirit in which the intercourse between the members of the council and myself was conducted on their parts, that made me feel sufficient confidence to undertake the arduous duties proposed to me."

* * * *

We are, indeed, glad to learn that such is the present state of things as regards the college, and most glad to be able thus to exempt the present council from the general charges of selfishness, recklessness, and incapacity with which we charged the earlier members; and which we charged in a form, too, that would seem to include the whole of them down to the present time. We also feel greater confidence in the stability of the college, and in the improvements introduced into it being permanent.

We have been verbally informed by the gentleman to whom the preceding note was written, that the members of the present council subscribed *a thousand pounds each*, as a fund for accomplishing the purposes mentioned above; and that they reserved to themselves no special advantages on this account!

We can no further open our pages to this subject, except it be to rectify any omission or mistake of importance which we may find ourselves to have made, or to admit explanations which any gentleman connected with the institution in former times may wish to make of the part which he took in its management, especially in reference to our own strictures. As we said to Colonel Jackson at the outset, so we say to every one now—"fair play and no favour!"

CONSTRUCTION OF HARBOURS AND WET DOCKS.

In the construction of harbours, Smeaton had pointed out the proper course in his reports on Lynn, Wells, Aberdeen, Dundee, Dunbar, Port Patrick, Sandwich, Scarborough, Sunderland, Workington, Rye, Dover, and others. Ramsgate harbour was originally designed by Labelye in 1744; it had been partly executed by others, and continued with little success through a tedious succession of years, with various changes of plan, until 1774, when it was placed under Smeaton's direction; he soon saw the evil arising from the constant accumulation of mud which threatened to fill it up, in consequence of there being no back water or scouring power to remove it. He therefore divided the harbour into two parts by a cross wall; the part next the shore formed a basin of eleven acres, in which the water could be retained by means of a lock, and discharged through powerful sluices in the cross wall into the outer harbour at low water, and thus form an effectual scouring power for removing the mud. Here was the introduction of a new principle for the maintenance of harbours, which is so difficult on an alluvial coast, operated upon by the tides and currents; and although previously in use on the Continent, it is believed to be the first example of the kind in Great Britain. Smeaton afterwards continued the works, and introduced an improved system of masonry; in 1788, he founded the outer and inner walls of the outer piers, below low water, by means of caissons or boxes of wood, and so far improved the diving-bell as to render it useful in carrying on the operations, although he did not build with it; and about the same time he used it for examining the foundations of the piers of Hexham bridge, one of which had partially sunk. The late Mr. Rennie, who after Smeaton's decease took

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charge of the works at Ramsgate, profiting by what had been done, carried out the system to a greater extent, by enlarging the sluices and making them of cast iron, the old ones being of wood and frequently out of repair; a greater quantity of water could then be discharged in the same time, when required, and thus act with greater effect; or the discharge could be prolonged, according to circumstances. The masonry also, which, although good for the early period at which it was constructed, had become dilapidated, was rebuilt, where requisite, in a much more substantial manner. The steam-dredging machine was also applied to remove that portion of the mud which could not be effected by the sluices. The diving-bell was afterwards perfected by Rennie, so as to be perfectly manageable, and being suspended from a frame worked by proper machinery, it could be raised and lowered, or moved laterally in any direction, with facility and promptitude, either according to the directions of the diver within the bell, communicated by means of signals, made by striking the sides of the bell with a hammer, or given by the superintendent above. All the operations for preparing a foundation, and afterwards laying the prepared blocks of masonry upon it, could thus be performed with as much certainty below as above the water. Rennie first used his improved apparatus in 1813 for rebuilding the advanced East Pier Head at Ramsgate Harbour, which was founded 17 feet below low water of spring tides with complete success. The value of this invention for sub-marine operations was now completely established, and he afterwards employed it with advantage in founding the pier heads and outer walls of Holyhead, Howth, and Sheerness Harbours, and other works under his direction, and it is now generally adopted in all similar circumstances. The diving-helmets and dresses, improved by Deane, Bethell, Edwards, Seibe, and others, have also materially contributed to the success of submarine operations.

After Smeaton, numerous artificial harbours were designed and constructed, and natural ones improved; amongst the former may be mentioned Holyhead, Howth, and Kingstown; at the latter there is a depth of 26 feet at low water of spring tides, and an enclosed area of 250 acres at low water; which is the largest harbour attempted in this country by Rennie. Here and at Howth he substituted the flat slope for the upright wall to resist the waves,* and introduced the plan of throwing down loose blocks of rubble, or unhewn stone, for forming the main body of the piers, allowing the slope or angle of repose, at which the materials would lie, to be formed by the sea. In his system of making low-water harbours, which, up to that period, were almost unknown in Great Britain, he adopted the plan of enclosing the area by piers composed of several straight arms or lengths, intersecting each other according to particular angles, instead of making them curved, which, in his opinion, only served to increase the action of the waves. In asylum harbours, when practicable, as at Kingstown, he preferred making the entrance open to the dangerous wind, thus rendering them more accessible for vessels in distress; but in order to prevent the prejudicial effects of any waves which might roll into the harbours, he adopted the returning and inclined form of entrance, by which means increased facility of entrance and departure was also given. He also designed his harbours with a view to preserving the original depth, as far as practicable, which is a principle of the greatest importance, and ought not to be lost sight of. The artificial harbours of Ardrossan, the Troon, Peterhead, by Telford, Scarborough, by Chapman, Hartlepool, and others, are worthy of remark.

In the improvement of natural harbours, may be mentioned Sunderland, Berwick, Aberdeen, Dublin, Newry, Drogheda, Leith, Belfast, and others. The principle generally adopted has been to confine and direct the tidal and fresh waters by piers, in proper and sufficient channels, whence they are discharged into the ocean, so as to enable them to act with greater effect in counteracting the baneful effects of the antagonist operations of the winds, waves, and sand, brought in from the sea; also to increase, as far as practicable, the receptacle for tidal and fresh waters, and to dispose of them in such a manner that they shall act with effect in maintaining and preserving the channels, These operations, as in the case of the Clyde, are materially assisted by the employment of that invaluable auxiliary, the steam-dredging machine, which ought to be attached to every harbour. I must not omit to mention the breakwater in Plymouth Sound, by Rennie and Whidbey, which is the first and largest example of a detached mole or breakwater in this country. It is a mile long, constructed in a depth varying from 5 to 8 fathoms at low water, formed of loose blocks of rubble, of all sizes, up to 10 or 12 tons weight each, thrown into the sea to form their own base and slope, according to the action of the waves. The surface from low water mark to its full height, which is 2 feet

* This system was latterly always adopted by Rennie and Telford in preference to the upright wall, as being better adapted to resist waves, and it has been invariably successful, wherever it has been properly carried into effect.

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above high water, has been paved with masonry, and at the base of the sea slope, at the level of low water, there is a berm or benching to protect it. At the western extremity a light-house has been built, to point out the western or principal entrance to the Sound, and a beacon on the eastern extremity points out the east entrance. The whole of the work, except a portion of the masonry, which is granite, has been built of limestone, brought from the adjoining shores. The intention of the work was to protect the Sound against the heavy swell which formerly used to roll in with considerable violence during strong westerly and southwesterly gales; this object has been completely obtained, and the roadstead has been rendered perfectly secure. The work has been eminently successful in every respect; for besides obtaining the desired protection, the original depth of water has been preserved, the facility of ingress and egress has not been diminished, but rather increased, and the cost has corresponded as nearly as possible with the original estimate.

Another class of harbours, called floating or wet docks, for receiving merchant vessels out of the tide or sea-way, was first introduced at Liverpool about the year 1716, and wet docks have been since constructed in almost all the principal ports of the kingdom; viz., London, Bristol, Hull, Leith, Sunderland, as well as for the royal navy at Portsmouth, Plymouth, Sheerness, Chatham, and Woolwich. The East and West India Docks, by Jessop, Rennie, and Ralph Walker; the London, Leith, and Dublin, by Rennie; St. Katharine's, London, by Telford; the New Docks at Liverpool, by Hartley; at Hull, by James Walker; at Cardiff, by Cubitt; at Newport, by Green; at Southampton, by Giles; and the great works now in progress at Birkenhead, on the Mersey, opposite Liverpool, and at Great Grimsby, by Rendel, are magnificent examples of private enterprise for facilitating the commerce of the empire. The design of Rennie for a grand naval arsenal on the Thames, at Northfleet, immediately above Gravesend, intended as a substitute for the imperfect naval establishments at Deptford, Woolwich, Sheerness, and Chatham, is worthy of remark. This magnificent design consisted of six capacious basins, with a total surface of 600 acres within the walls, the largest being 4000 feet long, and 1000 feet wide, and covering 87 acres; the whole to communicate with each other, and be provided with capacious quays, dry docks, building-slips, and storehouses; steam machinery for manufacturing cordage, blocks, anchors, flour and bread, sawing and converting timber, pumping, and working cranes; in fact, for almost every operation connected with the naval service, and so systematically arranged and disposed, that the required operations should succeed each other with the greatest despatch and economy, whether of time, labour, or cost. The estimate was 11,000,000*l.*, which was perhaps more than would have been required; any portion could have been executed as it was wanted, without interfering with the general plan. It is to be regretted that this plan was not carried into effect, for it would have repaid the cost in the increased economy of fitting out fleets, and since that period about 5,000,000*l.* have been expended on the old establishments in the Thames and Medway, with a small degree of benefit, compared with what would have been obtained from Northfleet. His design also for the improvement and enlargement of Chatham Dockyard is worthy of remark. It consisted of a new channel to be made for the Medway below Rochester Bridge, and converting the bend of the river, in front of the dockyard, into a magnificent floating dock of above 100 acres, and from thence making a canal, 1¼ mile long, 300 feet wide, and 30 feet deep, to the deep water in the Medway at Gillingham, by which means vessels of war of the largest class could come to the dockyard with the whole of their armament, which they cannot do now; the course to sea would have been shortened, and the shallow water of the Medway avoided: thus Chatham Dockyard would have been rendered the most convenient and extensive in Europe, and its proximity to London by a railway would have rendered the yards at Deptford and Woolwich unnecessary. The estimate for this work was only 700,000*l.*, whereas since that time fully as much, if not more, has been spent upon Woolwich with a very inferior result; indeed, it is not even too late to undertake this plan for Chatham now, and would well repay the expenditure. In designing and carrying into effect this important class of public works, so as to render them successful, a thorough knowledge of the nature and operation of tides, winds, currents, soundings, and all the departments of hydrography, physical geography, and geology is necessary, and in these sciences much is due to the exertions of Beaufort, Bullock, Washington, Denham, Buckland, De la Bêche, Lyell, Greenough, Sedgwick, Murchison, Phillips, and others.

Revetments, or retaining walls, had, until near the latter end of the last century, been usually built with horizontal foundations and courses, the interior side being almost vertical, and the exterior with a flat face and very little batter, or in many cases

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vertical. The curved face retaining wall was latterly introduced, with the foundation and courses inclining from the horizontal, so as to conform with the radius of curvature; this form of wall is preferable, in many cases, to the old, as combining greater strength with a less section, and being more convenient in other respects, and was commonly used by Rennie in his various works, when applicable.

To whom the introduction of this improved form of wall is due it is difficult to ascertain with accuracy; but Rennie, Ralph Walker, and Jessop were amongst the first who brought it into use. A further improvement was made in the retaining walls used at Sheerness in 1815 by Rennie, where the foundation being composed of soft alluvial mud and quicksand, to a great depth, more than usual precautions were necessary to render the walls substantial and secure. The object was effected by enlarging the base, and making the interior hollow, like a caisson, with the bottom in the form of an inverted dome; the outer or river face being concave, and the foundation, for a certain width, laid reclining at right angles to a tangent from the curved face of the front of the wall; the remainder of the foundation was horizontal, and the back or land side of the wall was vertical. Thus there was both a front and back wall connected together by cross walls, forming one mass; the inverted arches or domes under the hollow spaces being filled with chalk and gravel concrete, and the whole resting upon a well-connected platform of piles and cross-beams and planking. By thus distributing the same quantity of materials over a greater surface, the vertical weight per square foot was reduced, and the desired stability was obtained upon this very difficult and treacherous foundation. Rennie had previously tried, with success, a wall of a similar principle, and under similar circumstances at Grimsby. General Bentham also tried a similar principle, about the same time, which was not so successful, in consequence of an unsuitable form and construction.

The coffer-dams which Rennie employed for constructing the walls at Sheerness are worthy of remark, as being the most extensive and difficult that had been constructed up to that period. The bottom being soft mud to a considerable depth, piles of 60 feet to 80 feet in length were necessary, and when driven and braced in their places as far as practicable, chain bars and raking-shores from the land were requisite, in order to counteract the alternate pressure inwards and falling outwards, occasioned by the badness of the foundation and the heavy shocks of the waves to which they were exposed. In order to break the effects of the sea during storms, he employed a series of old men-of-war hulks, to act as floating breakwaters; these were useful to a certain extent, so long as they held firm in their places; but at times, during heavy gales, they dragged their moorings, and driving against the dams, occasioned considerable damage; upon the whole, however, they were useful.* In order to give greater security to the dams, and to prevent leakage, a considerable quantity of grooved and tongued sheathing-piles were necessary for the works; and to effect this, he invented a machine worked by a steam-engine, which answered the purpose effectually, at a cost of one-sixth of the price of manual labour, and as it was unsafe to withdraw any of the coffer-dam piles, he made another machine for cutting them off at the ground level, below low water, which was also found very useful.

The dams for founding the sea-locks of the Caledonian canal at Fort William and near Inverness, by Telford, are worthy of remark. In the former case great difficulties arose, in consequence of the foundation being rock, at some depth below low water; this was overcome by ingeniously securing the piles to the rock; and in the latter case, where the bottom was soft mud, the difficulty was obviated by bringing cargoes or masses of earth and clay from a considerable distance, and afterwards driving the piles through the made ground. The great dam, 1000 feet in length, for building the foundations of the river-wall and New Houses of Parliament, by James Walker, is another good example. The late Peter Ewart was among the first who introduced cast and wrought iron for dams, for piling in general, and for wharfs; it has been since employed by Walker, Sibley, Stephenson, and others, in many situations, with great success. At the Albion Mills, already mentioned as the first steam-mill constructed in 1785, by Watt and Rennie, on the banks of the Thames, close to Blackfriars-bridge, the foundation being soft mud and moving sand, inverted arches were formed upon the ground, between the foundation courses of the walls, so that the whole area of the building obtained support by the same weight resting upon an increased base.—*Sir John Rennie's Address to the Institution of Civil Engineers.*

* Floating breakwaters of timber have latterly been tried, as a substitute for more solid constructions, but they have not hitherto succeeded.

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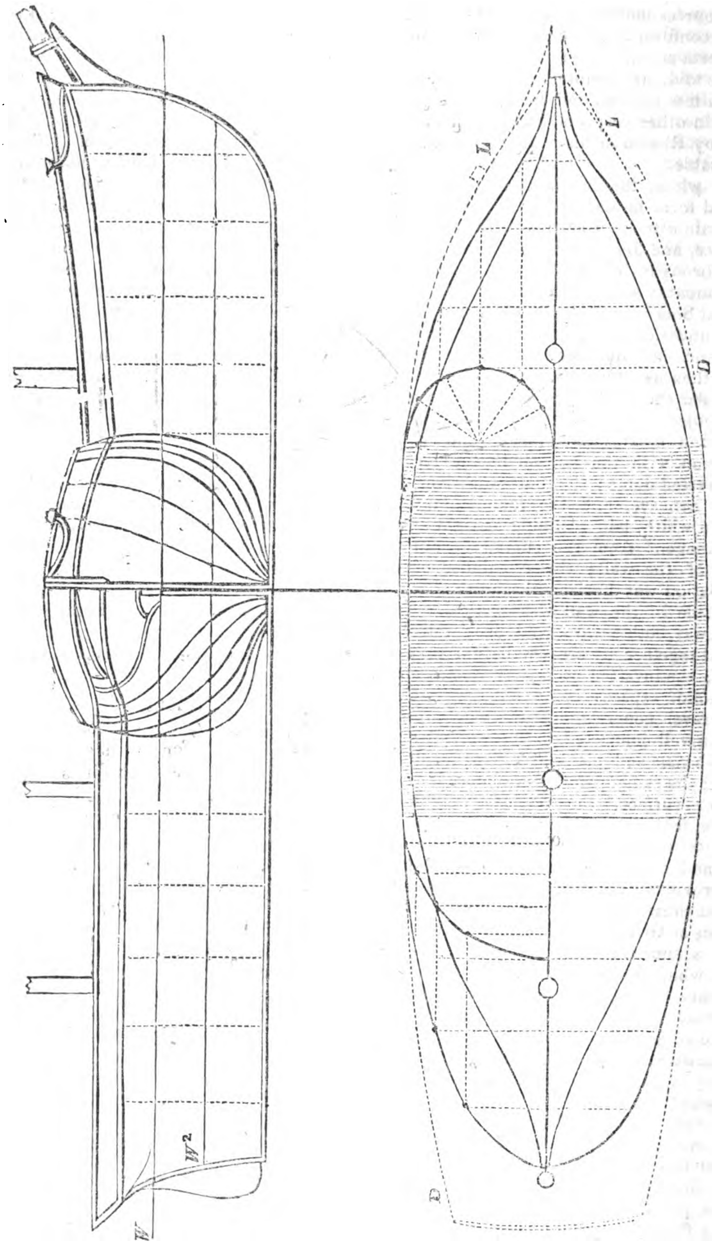
DESIGN FOR A MERCHANT VESSEL ON THE WAVE-LINE PRINCIPLE.



Sir,—In compliance with the request of a "Shipowner," I forward to you some diagrams explanatory of the method of forming the water-lines of the

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bows and sterns of ships, which was submitted to the British Association by Mr. John Scott Russell, as giving a near approximation to the forms best adapted for velocity.

On referring to his reports on waves and ships, &c., to the British Association, it appears that different velocities require different forms, and I apprehend the details of the experiments and their results are in course of publication in a form that it is considered will be most conducive to the wants of the ship-builder.

The methods here given may obviously be applied to different spaces on the bows and sterns, to give any required amount of fulness or fineness; still keeping the general relations of the spaces to each other, they produce water-lines only which can be easily adapted to any form of frame timbers. In case a large body were deemed requisite, the addition is directed to be made to the midship body.

Fig. 3.

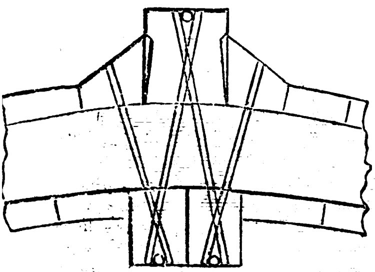
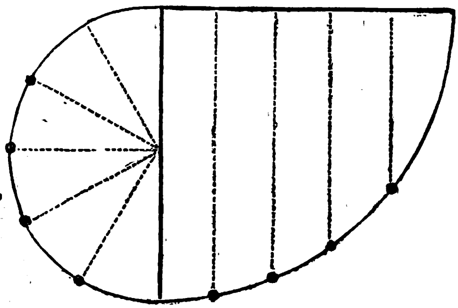


Fig. 1. Fig. 2.



It should, however, be remembered that the statements I speak of referred chiefly to steamers having a speed exceeding 15 miles per hour. The application of these diagrams in the annexed draught of a merchant's ship, 90 feet in length and 24 feet in breadth at the surface water-line, is consequently liable to error. As cargo is commonly a principal object, the midship body has therefore been taken at 30 feet in length, and the diagrams have been used to form a bow and stern, each of 30 feet in length.

The masts are kept in the position of a vessel 80 feet only in length, of the same breadth, but of the common full-bowed construction; about 8 feet has been added forward and 2 feet aft, and these additions would tend to produce greater speed with the same power or area of sails.

Fig. 1 represents the lines proper for forming the bow, or fore-body.

Fig. 2, those for the stern or after-body. DL are the deck lines; W^1 the upper water-line; W^2 the middle water-line. The stern and bow spaces between the vertical lines represent the outside of the planking, not the frame timber as usual.

Fig. 3 is a modification, in a simple form, of the keel introduced by Mr. Oliver Lang in Her Majesty's dock-yards, with thick garboard strakes worked plain, and bolted to the kelson, formed of two pieces of timber.

I am, Sir, yours, &c.,

A. Z.

PERPETUAL MOTION NOT FOUND YET!

Mr. Editor,—Your able correspondent, "A. H." is not likely to commit any oversight in his integrations, and the results he has obtained (*Mech. Mag.*, p. 107) must have agreed with those of Mr. Adams himself. The only question then is that of interpreting these results; for the results themselves are correct.

"A. H." considers their strangeness to arise from the mode in which the solution of the differential equation was resolved. Vary the mode as we may,

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the value of $\frac{d\theta}{dt}$ will tell the same tale under the same relative values of m and n. By this consideration, therefore, the conclusion cannot be "satisfactorily explained."

Mr. Adams, in proposing the question, *implies* perpetual motion by saying, that, under specified circumstances, "the disc will not come to rest at all;" which, *if motion could have ensued under the circumstances*, would have been a justifiable interpretation of the equation for v, however strange the conclusion might seem to be.

The fact is, that when $m=n$, we have the *limit* at which motion can commence; and that when m is greater than n, all motion is *impossible*, as the expression of it is then imaginary. In fact, did not the value of v become imaginary, but negative under the specified circumstances, it would follow that the velocity would be in a direction *opposite* to that produced by the torsion of the wire, or, which amounts to the same thing, that friction could *generate motion*—which is manifestly absurd.

The conclusion, then, to which we are led by the solution of "A. H." is, that *motion could not ensue*—not that it would be *perpetual*. I am, Sir, yours, &c.,

PEN-AND-INK.

Charlton, Jan. 30, 1847.

JOHNSON'S PATENT IMPROVEMENTS IN HATS.

[Patent dated June 18, 1846; Specification enrolled December 18, 1846. Patentee, A. R. Johnson, of the firm of Messrs. Johnson and Co., of Regent-street, and Messrs. Griffiths and Johnson, of Old Bond-street.]

Mr. Johnson, who has already distinguished himself as an improver of hats, has, by the inventions which form the subject of his present patent, greatly increased his claims to the patronage and support of all who study health, cleanliness, and comfort, in this article of dress. The means he has contrived for producing perfect ventilation, surpass alike in ingenuity and efficiency everything of the sort which has yet appeared. His new combinations of materials for the foundation of bodies of hats, possess also great originality, and seem likely to contribute materially to those important qualities—lightness and impermeability. We extract the following particulars from the patentee's specification:

My invention consists,

Firstly, In the employment of a new composition for stiffening the bodies, or foundations of silk hats, and cementing together the parts of such bodies or foundations, and in the manner of forming such bodies or foundations when the said composition is used. I prepare the composition in manner following: I make a solution of shellac in spirits of wine, or other suitable solvent, and while it is in a warm state I add to it a warm solution of gutta percha, in proportions varying from one part of gutta percha for every six parts of shellac, or one part of gutta percha for every twelve parts of shellac. When the composition so prepared becomes cold, it is wholly free from that brittleness which belongs to shellac. The solution, by itself, is very pliable, and softens readily without running when subjected to the warm ironing processes hereinafter mentioned. I prefer using the gutta percha in the proportion of about one to ten of the shellac, and do not recommend that it should be used in a less proportion than one to six, or more than one to twelve; but it may be employed with more or less advantage, in almost every variety of proportion, and I do not, therefore, limit myself to any particular proportions. The calico, muslin, silk, or other description of fabric, which is to form the body of the hat is first thoroughly saturated with the said composition, and then stretched on a frame and set to dry. When dry the cloth is cut up into sides, tips, and other requisite pieces, and formed into a body by blocking as usual. The body is then coated evenly with the composition, and when that is dry it is done all over with a warm iron (in the way usual in hat making.) The remaining processes of varnishing, laying on, and ironing the silk shag, or plush, and finishing, are then gone through in the ordinary manner.

Secondly, My invention consists in the formation of the bodies, or foundations, of hats, caps, and bonnets of a new combination of substances possessing much greater lightness than any heretofore in use for that purpose. I employ for my principal material the pith of a species of sedge, which is known in the East Indies by the name of *Shola*, and is, as I am informed and believe, the *Æschynomene aspera* of Linnæus. I slice it into strips of any required thick-

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ness, and form each piece of the body of the hat, cap, for bonnet, of a number of these strips laid alongside of one another, and united into one by cementing to them on both sides pieces of jaconnot muslin, or any other slight fabric. I prefer to use for my cement the composition described under the first head of this specification, but any other cement that will unite pith and cloth together may be employed.

Fig. 1.

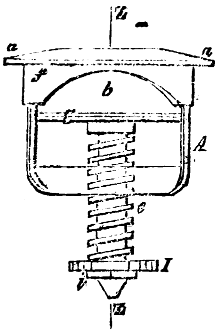


Fig. 3.

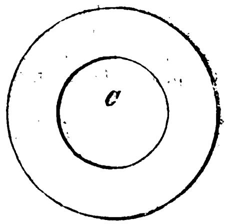


Fig. 2.

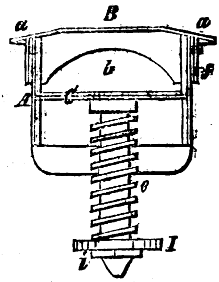


Fig. 4.

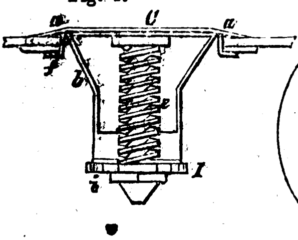


Fig. 6.

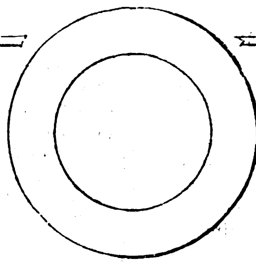


Fig. 5.

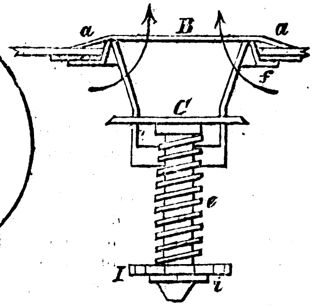


Fig. 7.

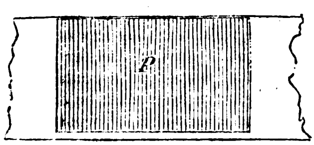
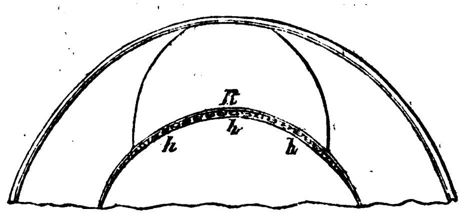


Fig. 8.



Thirdly, my invention consists in constructing hats, caps, and bonnets in such manner that the air inside may be kept either cool or warm, according to the pleasure of the wearer. I effect this by means of two appendages; first, by means of a small valve which is inserted in an aperture made in the crown of the hat, cap, or bonnet, and is capable of being opened or closed, and that either wholly or partially; and second, by means of an air-piece inserted in the back of the hat, between the body and leather part of the lining (technically called "the leather,") and containing a number of passages, which are always open to the external air. When the top valve is open, there is a continuous current of cool air flowing from the passages of the back

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air-piece up into the interior of the hat, cap, or bonnet, and out through the top valve, whereby any accumulation of heated air over the head of the wearer is entirely prevented; and should the temperature of the weather make it desirable to have this current diminished, this is readily effected by the partial closing of the top valve. When again the top valve is wholly closed, the heated air accumulates, as usual, inside the hat, but only to a limited and not injurious extent; for as soon as it becomes in excess of the external atmospheric pressure, it escapes downwards through the passages in the back air-piece. The top valve may be made of various convenient forms; but that which I prefer as most generally suitable, is represented in figs. 1 to 5 (both inclusive.) Fig. 1 is an elevation on an enlarged scale of the valve; fig. 2, a vertical section of it; fig. 3, a top plan; and figs. 4 and 5, two different sections on the line *z z* of fig. 1. A is a circular metal stud, which is inserted from the outside through the aperture in the crown of the hat, or cap, or bonnet, and rests by the rim *a a* upon the outer surface of the crown. A washer (fig. 6) is then slipped over the under part, *f*, of the stud, and that part pressed back, as shown in fig. 4, against the washer. The stud is thus firmly secured in its place. B is a circular orifice in the centre of the top of the stud, and *b b* side apertures, which are formed by cutting away the body of the stud, in the manner shown in the sectional view fig. 5, and through which apertures the heated air escapes, as indicated by the arrows. C is a plug, by means of which the orifice B on the top of the stud may be wholly closed, or the side apertures, *b b*, be partially closed, according as a change of temperature, or the coming on of rain or snow, may render advisable. This plug is raised or lowered by a screwed spindle, *e*, tapped through the bottom of the stud, and acted upon by means of a button, I, which is held fast by a nut, *i*. In fig. 4 the valve is shown as fitted to the crown of the hat, cap, or bonnet, and the plug C as screwed up into the orifice B. In figs. 3 and 5 the plug C is represented as being open, and the heated air as escaping through the apertures B, *b b*, into the atmosphere. The construction of the back air-piece is represented in figs. 7 and 8; fig. 7 being an elevation of so much of the back part of a hat as is necessary to show this addition, and fig. 8 a plan of the hat, the better to display the course of the air passages. It is made of a thin piece of cork, P, with a number of grooves on the inner face of it, which is inserted between the body of the hat, cap, or bonnet R and the leather S. The leather is brought over the top of the air-piece, and perforated on the edge (just inside of the stitching) with holes, *h h*, to correspond with the grooves of the air-piece. The air-piece may be attached either to the leather before it is sewn in or to the body of the hat; but I prefer the former method, as being the more convenient. Instead of the air-piece being confined to the back part of the hat, as represented in figs. 7 and 8, and before described, it may be carried all round, or half round, or to any other extent deemed expedient; but, in general, an air-piece of the size shown in the drawings, will be found sufficient.

Fourthly, my invention consists of a new covering for the outside of hats, to be used in place of beaver or silk. It consists of an elastic fabric, which may be formed in three different ways; first, the warp may be composed of threads of caoutchouc, wholly or partially countered or covered with threads of wool or silk, or by a mixture of wool and silk, or partly of caoutchouc threads, as aforesaid, and partly of threads of wool or silk, or a mixture of wool and silk, and the shute or weft may be composed of threads of wool or silk, or a mixture of wool and silk; or, second, the warp may be of wool or silk, or a mixture of wool and silk, and the shute may be of threads of caoutchouc, wholly or partially countered with threads of wool or silk, or a mixture of wool and silk, or partly of threads of caoutchouc and partly of threads of wool, or silk, or a mixture of wool and silk; or, third, the threads of caoutchouc, whether employed as warp or woof, may be used in an uncovered state. The countering or covering of the threads may be effected by any of the methods in ordinary use for the countering of thread or twine. The fabric may also be woven either in end or selvage pieces, or in circular or endless pieces, of any required size, by any of the machines or methods now in use for such purposes. But when woven in circular or endless pieces, the warp used must be either of wool or silk, or a mixture of wool and silk, and the weft may consist either wholly of threads of caoutchouc, covered or uncovered, or partly of threads of caoutchouc, covered or uncovered, and partly of threads of wool or silk, or a mixture of wool and silk; and so in all cases where the caoutchouc thread, covered or uncovered, is used, whether as warp or woof, in combination with other threads, it is to be so woven in that the wool or silk threads, or mixed threads of wool and silk, shall be thrown out to one or other face of the fabric. When the sides and brims of hat coverings are cut out of end or selvage pieces, they are joined by stitching before putting on, and

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allowance made for the elasticity of the material; but I find it preferable to have the fabric woven in circular and endless pieces, of sizes which, when a little expanded, will correspond with the sizes of the tips and brims, so that when drawn or stretched over or upon their respective foundations, they will form coverings without any seams.

And, *fifthly*, my invention consists in forming mourning and other hat-bands of the elastic fabric last hereinbefore described. I prefer making them circular without seams, in the same way as the side pieces for hat coverings before described; but they may also be made of end pieces stitched together, and in both cases they must be woven at top and bottom with what are technically known by the name of covered selvages, (as distinguished from raw,) in order to prevent them from curling.

THE TYRES OF RAILWAY WHEELS.

A frightful accident has occurred on the Great Western Railway from the rupture of the steel tyre of one of the driving wheels of the engine of an express train. A piece of the fractured tyre, weighing 275 lbs., was projected to the height of between 20 or 30 feet in the air, and descending upon one of the carriages of the train, crushed two of the passengers to death, and severely wounded some others. The engine was going at the time at the rate of about 60 miles an hour. From the evidence taken at the inquest on the bodies of the sufferers, it appeared that such accidents are by no means uncommon. Mr. B. Cubitt, who was examined on the occasion, recommended that, to prevent such accidents in future, the tyres should be secured by screw rivets passed through from the inside of the wheel at every 18 inches. Mr. M'Connel and Mr. Braithwaite concurred in this recommendation, and the jury embodied it in their verdict.

Are we, therefore, to conclude that there is no other or better remedy? Is there not an inevitable tendency in all tyres, which are shrunk on hot, (like all those on the Great Western line,) and acquire their hold merely from the contraction which takes place in cooling, to expand, and lose that hold when again heated and expanded? Will not screws of the body in which they are inserted, moreover, get also loose from the expansion? Mr. Cubitt himself, in recommending screwing, gave it only as a *pis-aller*—"I only know of one thing, and *that* I don't think *certain* in its operation." We described a few weeks ago in our journal (No. 1221) a railway wheel invented by Mr. Melling, of Rainhill, in which the tyre is put on cold, and secured by a fillet on the under part, that takes into a recess in the felloe. We think this a much better mode, than the screwing, of averting the repetition of such disasters, and recommend it to the attention of railway companies.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS, FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 117.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

Mayer Oppenheim the eldest, of the city of London, merchant: specification for "a method entirely new, for manufacturing of red transparent glass, which will be of general utility." Nov. 28, 29 Geo. 2; Dec. 5, 1755.

John Wright, of Lower Redbrooke, (Gloucester,) refiner: specification for "a new method of raising steam for working fire engines," whereby many collieries and mines that have been worked to so great a depth as to be at present of little or no value to the proprietors, by reason of the great expense of coal in draining them by fire engines, may, by means of the present invention, be worked with considerable advantage. May 27, last past; Aug. 14, 30 Geo. 2, 1756.

John Ladd, of Trowbridge, in the county of Wilts, surveyor and dealer in timber: specification for "a new method of making and constructing, on mechanical principles, waggons, wains, carts, and other wheel carriages and rollers, for roads, tilled lands, walks, and gardens," which, without any horses, and with a very moderate human force, will move great weights, where there are not very steep ascents, and will move the same in very hilly places, with a much less number of horses, than those of the ordinary construction; the mechanism is also designed for coaches, &c. April 9; April 29, 32 Geo. 2, 1757.

Isaac Wilkinson, of Barsham Furnace, in the parish of Wrexham (Denbigh): specification for "a new kind of bellows, which may be made either of cast iron, wrought iron, iron, wood, lead, or any kind of metal,

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for the blowing of furnaces or forges, at any distance, to be wrought or put in motion by water or fire engines," which would be of great benefit in making pig or bar iron. March 12, 1757, June 1, 1757.

John Rowe, of Parransands (Cornwall), gent.: specification for "A mill for grinding all sorts of mineral ores, in a manner never heretofore practised." May 27, 30 Geo. 2; July 11, 31 Geo. 2, 1757.

Thomas Greenough, of the parish of St. Martin, Ludgate, apothecary: specification for "New invented medicines, for giving immediate relief in pains and disorders of the stomach and bowels, and other membraneous parts of the body;" one called Volatile Balsam, and the other Stomatick Lozenges. Oct. 31, 31 Geo. 2; Feb. 16, 1758.

William Harrison, of Red Lyon-square (Middlesex), watchmaker: specification for "Certain engines, called coach-springs, whereby coaches, chariots, berlins, chaises, machines, and carriages of all kinds may be hung with the utmost safety, ease, and pleasure to the persons who ride in them." A parchment schedule of drawings is attached. Nov. 11, 31 Geo. 2; Feb. 18, 31 Geo. 2, 1758.

Isaac Wilkinson, of Barsham Furnace, in the parish of Wrexham (Denbigh): specification for "A new method of casting guns or cannon, fire-engines, cylinders, pipes, and sugar rolls, and other such like instruments, in dried sand, in iron boxes made for that purpose," whereby they will be cast more exactly, cheaply, and expeditiously than by any method now known. April 21, 31 Geo. 2; August 1, 32 Geo. 2, 1758.

John Champion, of the city of Bristol, merchant: specification for "Making spelter and brass from a mineral which has not hitherto been made use of for such purpose," called Black Jack, or Mock Jack, or Brazil or Redstone. July 28, 32 Geo. 2; Sept. 7, 1758.

Lewis Paul, of Kensington Gravel Pits (Middlesex), esq.: specification for "A new invented machine or engine for the spinning of wool and cotton by a mode or mean entirely new." June 29, 32 Geo. 2; Oct. 28, 1758.

George Gordon, coppersmith, and *Cuthbert Gordon*, merchant, both of Leith (Mid-Lothian), Scotland: specification for a valuable and beneficial dye, called Cudbear, for dyeing crimson and purple, so as in a great measure to supply the use of the Archelia, or Spanish weed, composed of materials entirely the growth of Great Britain or the colonies. Aug. 12, last past; Oct. 26, 1758.

Joseph Collett, gentleman, of the parish of St. Martin-in-the-Fields (Middlesex): specification for an "Antiarthritick wine and powder for the cure of the gout." Aug. 16, 32 Geo. 2; Dec. 6, 32 Geo. 2, 1758.

James Brindley, of Leek, in the county of Stafford, millwright: specification for "A fire (steam) engine for drawing water out of mines, or for draining of lands, or for supplying cities." Sept. 27, 32 Geo. 2; Dec. 26, 1758.

Edward Story, of the parish of St. James, Clerkenwell (Middlesex), apothecary: specification for "A new compound medicinal remedy, called Rotulæ Anthelminthicæ, or worm-destroying cakes, for eradicating the semina or seed of worms, and effectually destroying of worms, in the bodies of men, women, and children, and for cleansing the stomach and bowels from all manner of filth and slime, for giving immediate ease in cholics and gripes, and preventing their returns, and also for the cure of hydropical disorders, yellow jaundice, agues, hooping or chin coughs, bloody flux, and various other indispositions." Feb. 3, 32 Geo. 2; March 6, 32 Geo. 2, 1759.

James Poole and *William Ringsted*, of Long Acre (Middlesex), coachmakers: specification for "A new invented method of making coaches, chariotts, post-chaises, sedan-chairs, and other such like carriages, and covering the same on the outside with copper, iron, or brass, beautifully enamelled with gold or without, instead of leather, which, in addition to ornament, prevents the rain penetrating through them, as it often doth those covered with leather." Dec. 21, 32 Geo. 2; Mar. 5, 1759.

Jedidiah Strut, of the parish of Blackwall (Derby), wheelwright, and *William Wollatt*, of the same place, hosier: specification for "A new invented engine or machine for making of turned ribbed stockings pieces, and other goods usually manufactured upon stocking frames." A paper schedule of drawings of the machine is attached. Jan. 10, last past; Feb. 28, 1759.

Henry Brown, of the parish of St. James, Clerkenwell (Middlesex), dyer: specification for "A new art and method of dyeing, staining, and stamping of stockings and other apparel in all sorts of colours." Dec. 22, 32 Geo. 2; Mar. 15, 1759.

Henry Wood, of High Hercall, (Salop), clerk: specification for an "Invention for working a fire (steam) engine upon a new principle, different to any method heretofore used, and at less than half the expense of coals" [by hot air.] May 25, 32 Geo. 2; July 23, 1759.

Thomas Blockley, of Birmingham (Warwick), locksmith: specification for "New

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methods of polishing and rolling into different forms all malleable metal, and making of tyre for all sorts of wheel carriages." A plan of the shape of the rollers to be used in the process, is given in the margin of the roll. July 14, 33 Geo. 2; Nov. 8, 1759.

Henry Holloway, of Clapton, in the parish of Hackney (Middlesex), gentleman: specification for "A method entirely new for the raising of water." A parchment schedule of drawings of the invention is attached. July 14, 33 Geo. 2; Nov. 13, 1759.

Thomas Pease, of the parish of St. Martin-in-the-Fields (Middlesex), coach spring maker, and *William Monk*, of the parish of St. Margaret, Westminster (Middlesex), coachmaker and wheelwright: specification for "A new and particular kind of axeltrees, whereby vehicles and carriages will be rendered much more commodious, and be better fitted for travelling in the different roads; will be drawn with less labour and strength, greater safety, more steadiness, and less agitation; will preserve the wheels from taking fire," &c., &c. A parchment schedule of drawings is attached. Nov. 29, 33 Geo. 2; Mar. 3, 33 Geo. 2, 1760.

William Riccards, of the parish of St. Mary Matfellon, otherwise Whitechapel (Middlesex), merchant, and *Richard Russell*, of the same parish and county, glassmaker: specification for "A new invention of making potts and building furnaces for the making of crown glass, plate glass, and all sorts of green glass." Jan. 17, 33 Geo. 2; May 12, 1760.

Edward Calvert, of Norton Folgate (Middlesex), druggist: specification for "A most pleasant and useful cordial, called the Violet Cordial," which is a fine and gentle reviver of the animal spirits, and the finest medicine to expel wind. Feb. 21, 33 Geo. 2; May 19, 1760.

Henry Jenkins: specification for "A new machine, or regulator, intended for the better discovery of the longitude at sea; to go by a pendulum of any length, which, by a peculiar construction, will vibrate seconds in a true and regular manner, when on board a ship at sea, and, although partaking of all the motions and particular directions of such ship, yet will not in the least be thereby obstructed, whether the same machine, or clock, goes by weights or springs." [Marine Regulator.] Jan. 31, 33 Geo. 2; May 24, 1760.

Thomas Perkins, of the parish of St. Paul, Shadwell (Middlesex), engineer: specification for "A geometrical scale beam engine that will discharge two streams [of water] at once, with a lesser quantity of hands to be employed to work the same than any other engine heretofore invented; to be used for extinguishing fires, and for ships at sea which are leaky." Mar. 4, 33 Geo. 2; May 24, 1760.

Joseph Stell, of Keighley (York), merchant: specification for "A new method of weaving figured and flowered silk ribbons, and other sorts of figured and flowered goods made in narrow breadths, and of different materials, so as to work a great number of pieces at one time." Oct. 22, 34 Geo. 2; Dec. 1, 1760, 1 Geo. 3.

Thomas Winter, the elder, of Liverpool (Lancaster), mariner; *John Dolland*, of the Strand (Middlesex), optician; *Daniel Scatliff*, of the parish of St. John, Wapping (Middlesex), shipchandler; and *Henry Gregory*, of the City of London, mathematical instrument maker: specification for "A quadrant for taking observations at sea." Oct. 2, 34 Geo. 2; Jan. 10, 1761.

Francis Xavier d'Arles de Liniere, late of Suffolk-street, in the parish of St. Martin-in-the-Fields (Middlesex), esq., but now resident at the Hague, in Holland: specification for a pump of a new mechanism and construction, which, with less force, yields a much greater quantity of water than any pump in use, and is made in such a manner that the diameter of the drawing pipe, and that of the opening pipe of the valve in the sucker, are almost equal to the diameter of the body of the pump; it works without friction of the sucker, and the piece made use of instead of a sucker is a solid body, without leather; this pump also has the advantage over any other now used, for its simplicity and lightness, being easy to be removed, requiring little or no expense to keep in repair, and not being liable to be worn out, or hurt, by sand, mud, and filth, which frequently put others out of order, and having no friction of its sucker, is of so lasting a nature as scarce to be worn out, &c. Nov. 27, 1 Geo. 3; March 3, 1761.

Francis Xavier d'Arles de Liniere (see last entry): specification for "A machine, upon new principles, for exerting the power of men to the greatest advantage, applicable to many other machines in most cases where moving forces are required, and whereby the number of men designed to act may be either increased or diminished at pleasure, from one man to two hundred and more, without lengthening the lever," &c.; to be applied to driving piles, works in canals of communication, stirring and raising of earth, clearing rivers, &c. Nov. 27, 1 Geo. 3; March 3, 1761.

Henry Wright, of the parish of St. Michael, in the city of London, chymist: spe-

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cification for "A new medicine, called Caryophilius Regius, or Royal Clove Drops, for cure of pains in the stomach, shortness of breath, coughs, hooping coughs, cold chills, fits, and the worst symptoms of consumptions." Dec. 11, 1 Geo. 3; March 21, 1761.

William Hayter, of Hatton-garden, (Middlesex,) leather seller: specification for "A new composition, and peculiar method for staining of leather. Feb. 5, 1 Geo. 3; May 16, 1761.

Michael Meinzies, esq.: specification for his "New method of working mines of coals and metals by a new machine, invented by him for hewing and, in some cases, draining them; to be set in motion by a fire-engine, a water-miln, a wind-miln, or by a horse-gin." May 20, last past; Sept. 7, 1 Geo. 3, 1761.

Thomas Jackson, of the city of London, chymist: specification for "A powerful specific, called the Imperial Lotion, effectual in the immediate cure of any infection or injury received from persons afflicted with a certain disease," &c. Sept. 1, 1 Geo. 3; Dec. 31, 1761.

David Marie, watchmaker, of the parish of St. Martin-in-the-Fields, (Middlesex): specification for "A new construction for the making of watches, so contrived as to perform without a chain, is wound up by a single turn, and is thereby kept in motion thirty hours, and during the time of winding continues its usual motion, which entirely prevents it from losing any time, and let the watch be wound either way it cannot receive any damage." A brass watch-plate is attached. April 21, 2 Geo. 3; August 5, 1762.

John Walkingshawe, of Borrowstowness, (Linlithgow,) coalviewer: specification for "A new invented engine, being a sort of catapult for working of mines and pits, after a new and different manner, and with far less expense than the method now used." ——, 2 Geo. 3, 1762; August 30, 2 Geo. 3, 1762.

John Wood, of Bierley, (York,) smith: specification for "A new invented warming pan, or engine for warming of beds by warm water." July 6, 2 Geo. 3; Oct. 30, 1762.

John Juniper, of the parish of St. Ann, Soho, Westminster, chymist and apothecary: specification for "A new medicine called 'Essence of Pepper Mint,' which contains all the virtues of that plant, and is an excellent remedy in cholics, retchings, sickness, and all disorders arising from flatulency," Nov. 11, 1762; Feb. 28, 1763.

Elizabeth Taylor, of the Town of Southampton, widow, relict and executrix of Walter Taylor, of the same place, blockmaker: specification for a set of engines, tools, instruments, and other apparatus for the making of blocks, sheavers, and pins, whereby the patentee has been able to supply his Majesty's navy with all kinds of ship rigging and gun tackle, blocks, sheavers and pins in iron, brass and wood, more certain and efficacious in their operation than any before used, and which are a great saving of ships' cordage and rigging. And stating that in the month of July last a trial of the said blocks had been made at his Majesty's yard at Deptford, in the presence of the principal officers of the navy; and that the commissioners of the navy had contracted with the patentee for the supply of those blocks for the navy. Dec. 6, 3 Geo. 3; March 12, 3 Geo. 3, 1763.

James Knight, of Brindgwood, (Hereford,) esq.: specification for "A new method of making and drawing iron and other metals, by a new kind of wood bellows, for producing blast to heat or melt the metals; and a new method of forge harness, by which the iron and other metals when heated *is* drawn out." Dec. 13, 3 Geo. 3; March 23, 3 Geo. 3, 1763.

Charles Burne, of Sunderland, (Durham,) coal fitter: specification for "two certain kinds of keels or vessels, depending partly upon each other, by which ballast may be taken out of ships, sand-beds in rivers taken up, harbours deepened, banks of sand and gravel at the entrance of ports removed and conveyed into a sufficient depth of the sea at a much less expense, and not so great a nuisance by far to the rivers and receivers as at present, or any other method hitherto invented for that purpose." Two paper schedules are attached, one being a draught of the invention, and the other a description thereof. March 3, 3 Geo. 3; May 9, 3 Geo. 3, 1763.

George Davy, the younger, of the parish of Whitechapel, London: specification for "A new method of making orchell from rock or stone moss of the growth of Great Britain and Ireland, which answers all the purposes of dyeing, as orchell made from foreign orchell weed or moss." Jan. 21, 3 Geo. 3; May 13, 1763.

Nathan Smith, of Fenchurch-street, London, painter stainer: specification for "A certain composition to be used as the ground work in making of painted floor cloths, devoid of all size, glue, or any other ingredient now used in the ground work of painted floor cloths: and a certain mill, engine, or machine, to be used in applying such composition." March 15, 3 Geo. 3; June 15, 3 Geo. 3, 1763.

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Samuel Emsley, of Wakefield, (York,) woollen draper: specification for "A preparation called Water-proof, whereby to prevent rain water from penetrating woollen cloths and hats." April 1, 3 Geo. 3; July 29, 1763.

Joseph Oxley, of Russell Factory, (Northumberland,) miller: specification for "A new machine for the drawing of coals out of coal pits, and for other purposes, by the help of a fire (steam) engine." July 29, 3 Geo. 3; October 5, 3 Geo. 3, 1763.

William Bill, of the city of London: specification for "A new machine to make chocolate, which is done in a very clean and expeditious manner." Nov. 3, 4 Geo. 3; January 12, 4 Geo. 3, 1764.

Stephen Goulder, of the parish of St. Ann, Limehouse, (Middlesex,) sail cloth weaver: specification for "A composition to be used in manufacturing canvas for sail cloth, which will prevent the same from mildewing when packed or stowed up damp, or in damp places, and will render the same equal, if not superior, to that which is made in Holland, called Holland's duck." Dec. 15, 4 Geo. 3; April 9, 1674, 4 Geo. 3.

Peter Browne, of the parish of St. Mary-le-Bow, in the city of London, painter: specification enrolled pursuant to patent granted to the said *Peter Browne* and *John Tempest Christian*, of Smarden, (Kent) for "A new method of painting silks and sattens in oil colours, and of rendering them durable of preserving the colours from the common injuries arising from water or friction, which invention affords the elegance of rich brocade to the slightest lutestring." Jan. 18, 4 Geo. 3; May 12, 4 Geo. 3, 1764.

Joseph Thornhill, of Fenchurch-street, in the parish of St. Catherine Coleman, London, mariner: specification for "A horizontal wheel of a construction entirely new, which, when properly fixed, never needs either moving or shifting to front the wind, by which it is turned, but is always open and ready to receive it from every point of the compass, and capable of performing all the light and heavy work of the common windmills, and will not shake the building upon which it is erected in its swiftest motion, or upon its being instantaneously stopt in the smartest gale." March 15, 4 Geo. 3; June 20, 4 Geo. 3, 1764.

Evan Deer, of South Shields, (Durham,) gentleman: specification for the application of the refuse or waste used in the making of allom, called allom slam, hitherto esteemed of no use, to the same purpose as the sea weed called kelp, viz., the fluxing and making of glass bottles and other green glass, and making of soap. Sept. 22, 4 Geo. 3; Nov. 22, 5 Geo. 3, 1764.

James Williamson, of the parish of St. Andrew, Holborn, (Middlesex,) founder: specification pursuant to patent granted to the said *James Williamson* and *Joseph Spackman*, then of Fenchurch-street, but now of Cornhill, London, pewterer, for "a new method of turning ovals in pewter, English China, and all other earthen wares." Dec. 5, 5 Geo. 3; Jan. 11, 5 Geo. 3, 1765.

John Norton, of the parish of St. James, Westminster, (Middlesex,) surgeon: specification for "a medicine called 'Maredant's Drops,' being an anti-scorbutic, and operating insensibly on the patient; exceeding all other medicines yet found out for the cure of the scurvy, leprosy, evil, fistulas, piles, ulcers, and all other disorders arising from a foulness in the blood." Nov. 30, 5 Geo. 3; Feb. 9, 5 Geo. 3, 1765.

Richard Williams, of the parish of St. Clement's Danes, in the city and liberty of Westminster, gentleman: specification for "a method of making a fine, thin, and light cloth of silk and wool," with the same appearance of superfine Spanish cloth, and superfine Irish ratteen that is little more than half the weight of clothing made of broad cloth. Jan. 29, 5 Geo. 3; Feb. 15, 5 Geo. 3, 1765.

Richard Brewer, late of the city of Dublin, in the kingdom of Ireland, but now of the city of London, gentleman: specification for "a new quadrant of altitude, applicable chiefly to the uses of navigation, whereby, notwithstanding the motions of a ship at sea, the mariner will be enabled with the greatest facility to take the altitudes of the sun, moon, and stars, when visible above the horizon by a direct sight at either object, without any regard to, or occasion for, any sight of the horizon; and to the exactness of a distinct minute of a degree and less; and is socontrived as to enable the mariner to ascertain the meridian at night, and consequently will enable him to find his latitude by any of the fixed stars whose declination is known." Nov. 14, 5 Geo. 3; March 13, 5 Geo. 3, 1765.

Friederieck Kehlhoff, late of the parish of St. George the Martyr, (Surry,) watchmaker: specification for "a new method of making watches." Nov. 29, 5 Geo. 3; March 28, 1765.

John Wilkinson, of the parish of St. James, Westminster, (Middlesex,) doctor in physic: specification for "preparing medicated baths, to be constructed on frames for floating on the river Thames, or elsewhere, adapted to the cures of many diseases not to be remedied by other known means; together with floats made of cork in form of seamen's waistcoats, or otherwise to be used there, or elsewhere, to prevent drowning,

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as also by seamen, or persons using the sea, in time of shipwreck or other accidents on water." Feb. 7, 5 Geo. 3; May 25, 5 Geo. 3, 1765.

Peter Holme, *Edward Cropper*, *James Nicholson*, and *Robert Nicholson*, all of Liverpool, (Lancaster,) merchants: specification for "a new method of making allom from liquor made from copperas materials and uncalcined ore equal in goodness to the best English allum." June 18, 5 Geo. 3; Sept. 6, 5 Geo. 3, 1765.

William Taylor, of the town and county of Nottingham, frame smith, and *Francis Jones*, of the same place, hosier: specification for "a new invented knitting machine for making and knitting of stocking, stocking-pieces, and other goods usually manufactured upon stocking-frames. June 15 last; Sept. 14, 1765.

Joseph Collett, of the parish of St. Martin-in-the-Fields, practitioner in physic: specification for leather catheters and bougies. June 5, 5 Geo. 3; Oct. 1, 5 Geo. 3, 1765.

Thomas Williams, of the parish of St. James, Westminster, (Middlesex,) apothecary: specification for "a restorative medicine, called essence of flowers of benzoin or pulmonic drops," for diseases of the lungs, &c. Dec. 3 last; March 17, 6 Geo. 3, 1766.

Thomas Hillcoat of the town and county of Newcastle-upon-Tyne, ironmonger: specification for "a machine for disengaging of horses from coaches, chaises, and such like carriages on any emergency, by which persons riding in any of those carriages may in an instant, with the utmost ease, set the horses loose from the carriage when going at any pace or on any ground whatever, whereby misfortunes by horses running away with carriages may be prevented." A parchment schedule of drawings of the invention is attached. Jan. 28, 6 Geo. 3; May 2, 6 Geo. 3, 1766.

Robert Fall, Esq.: specification for "a cheap method of heating all kinds of fluids by a new mechanical contrivance, whereby the fire is applied in a manner hitherto unpractised, so as to save a great expense of fuel, and heat the fluid in a much shorter space of time than usual, to the great benefit of the public, by rendering the consumption of fuel much less, and making that article so essential to life much cheaper, and by enabling the several persons who deal in factitious salts and liquors to sell the same at an easier rate to the consumer." March 25, 6 Geo. 3; May 6, 6 Geo. 3, 1766.

Charles Douglas Bowden, of Marygold Stairs, (Surry:) specification for "an hydraulick engine for raising water." A paper schedule of drawings of the invention is attached. Jan. 13, 6 Geo. 3; May 10, 6 Geo. 3, 1766.

William Martin, of Fenchurch-street, in the city of London, hosier: specification pursuant to patent granted to the said *William Martin* and one *Ann Robinson*, of Woburn, (Bedford,) spinster, for "a new method of making and manufacturing of silk mitts and silk gloves." A paper schedule of drawings of the invention is attached. Feb. 6, 6 Geo. 3; June 3, 6 Geo. 3, 1766.

Thomas Delaval, of Seaton Delaval, (Northumberland,) esq.: specification for "a certain composition or flux for the making of glass, consisting of ashes, sea water, copperas, and other ingredients. Also for a means of making gunpowder from sulphur stones, commonly called brasses, found in coal mines, and other ingredients, and those without the use of charcoal." April 22 last; May 29, 1766.

Charles Nicholas Michel Babu, of Jermyn-street, in the parish of St. James, Westminster, (Middlesex,) engineer in hydraulics: specification for a pump or engine, by which a greater quantity of water may be furnished or raised, than by any other engine hitherto invented, to discharge water from ships, mines, &c., and so contrived as to be worked by men, horses, fire, or water; also for an engine for readily extinguishing fires, so contrived as to bring immediate assistance where great fires happen. July 12, 6 Geo. 3; Nov. 11, 7 Geo. 3, 1766.

Francis Yerbury, of Bradford, (Wilts,) clothier: specification for "a new method of making thin superfine cloth for the summer season at home, and warmer climates abroad, yet, notwithstanding the thinness of its texture, it is more durable than cloth of a greater substance made in the common way." Aug. 26, 6 Geo. 3; Dec. 16, 7 Geo. 3, 1766.

Robert Dickinson, of the parish of St. Clement Danes, (Middlesex,) upholsterer, and *Henry Sedgier*, of Shire-lane, in the liberty of the Rolls, (Middlesex,) cabinet maker: specification for a bedstead of great use and conveniency to such as are confined to their beds by sickness, so that a person unable to assist or turn himself when lying on this bed may be raised by the nurse into a sitting posture by the turning of a winch, and let down again in the same manner, without the least shaking or inconvenience, or danger of catching cold, and by turning another winch the same bedstead may be converted into a convenient settee, and restored again to a bed without any inconvenience. Sept. 13, 6 Geo. 3; Jan. 10, 7 Geo. 3, 1767.

John Barber, of Standsby, (Derby,) esq.:

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specification for "an entire new method of raising water out of mines and ships, and for supplying cities, towns, and other places with water, and in general for raising ponderous weights of all kinds, particularly coals out of mines, by fire, by water, or by both jointly." A paper schedule of drawings of the invention is attached. Nov. 26, 7 Geo. 3; Feb. 19, 7 Geo. 3, 1767.

(*To be continued.*)

Wanton Damage to Electric Telegraphs. — If there is any one crime which more than others should excite universal indignation in the community, it is the sneaking villany of cutting the wires of the magnetic telegraph.—The prevalence of this scoundrelism, if not checked by the vigilance of the whole community, appears likely to defeat the enterprise, and deprive the public of the great and important benefits, as well as daily gratification, which should be derived from this greatest invention of the age. Since the Boston line has been put in operation, the wires have been cut, broken, crossed or otherwise deranged in more than twenty places, and at nearly as many different times; and these interruptions have frequently occurred just at the time that important news from Europe was expected. There have been various conjectures with regard to the motives which have induced this mischief; and it is supposed by some, to proceed from sheer envy against the rapidly advancing honour and prosperity of our country, under a system of free institutions and unbridled enterprise. But whether this mischief and vexation is induced by this or other vile motives, let no measures be neglected which may tend to secure the rights of our citizens against the depredations of the malicious, and bring the recreants to justice. If our Legislators will not enact laws and establish penalties sufficiently severe, let the citizens of the principal cities and towns which are most benefited by the telegraph, combine and offer liberal rewards, 1,000 or 5,000 dollars, for the detection or conviction of any person, of injuring the telegraph. And let every citizen residing in the vicinity of the telegraph lines, make it a point to obtain all possible intelligence among his associates and neighbours, that may tend to the detection of the perpetrators of these outrages on the rights of the public, and the life blood of our national prosperity.—*Scientific American.*

LIST OF ENGLISH PATENTS GRANTED FEB. 1, AND FEB. 2, 1847.

Thomas Barnabas Daft, of Birmingham, gent., for improvements in constructing inkstands, and in-fastenings to elastic bands. February 1; six months.

Richard Albert Tilghman, of Scott's-yard, Bush-lane, London, chemist, for improvements in the manufacture of certain acids, alkalies, and alkaline salts. February 1; six months.

Edward Newman Fourdrinier, of Chelddeton, Stafford, paper-manufacturer, for improvements in apparatus to be used for raising and lowering weights from mines and other places. February 1; six months.

John Thompson Carter, of Drogheda, in th- county of the town of Drogheda, Ireland, flax spinner, for improvements in machinery for crushing, bruising, and preparing flax, hemp, and other fibrous materials requiring such treatment. February 1; six months.

Marco Henry Franzoni, of Carrara, but now residing at Pelham-place, Brompton, Middlesex, sculptor, for improvements in obtaining and applying motive power. February 1; six months.

Benjamin Dawson Norton, of Cranford-bridge, Middlesex, gent., for certain improvements in cranes, and other hoisting and lowering machinery. February 1; six months.

Albert Tilghman, of Scott's-yard, Bush-lane, London, chemist, for improvements in the manufacture of certain alkaline salts. February 1; six months.

William Pidding, of Bernard-street, Middlesex, gent., for an improved mode of exhibiting and protecting certain coloured fabrics, ornamental inscriptions and other designs. February 2; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 23RD OF DEC. 1846, TO THE 21ST OF JANUARY, 1847.—CONCLUDED FROM P. 119.

Henry Constantine Jennings, of 6, Cumberland-terrace, Regent's-park, Middlesex, practical chemist, for a new method or apparatus, or machine, for the better or more economic evaporation of fluids or liquids containing crystalline or other matters to be concentrated or crystallized. January 12.

Lionel Campbell Goldsmid, of Rue Mogador, Paris, esq., for improvements in applying rudders to ships and other vessels. (Being a communication from abroad.) January 21.

John Buchanan, of Queen-square, Westminster, gent., for certain improvements in the construction of ships or vessels, and the propelling thereof January 21.

Advertisements.

To Engineers, Newspaper Proprietors, and others.

By Mr. FULLER, on Monday, February 22, at 11 o'clock, on the Premises, Gravel-lane, Southwark.

A FOUR CYLINDER STEAM PRINTING MACHINE, capable of working 4 to 5000 copies per hour, of a similar construction to those now in use at the "Times" Journal Office, highly finished and quite ready for immediate use. May be viewed on Friday and Saturday, previous to the Sale, when Catalogues may be had on the Premises, and of Mr. Fuller, 13, Billiter-street, City.

To Engineers, Millwrights, Machinists, Smiths, & others.

By Mr. FULLER, on Monday, February 22, and following days, at 11 each day, on the Premises, Paradise-row, Gravel-lane, Southwark, without reserve, the premises being let.

THE MACHINERY and TOOLS of an ENGINEER, the property of Mr. Lloyd, retiring from business:—Four steam-engines of 6, 5, and 4 horse power, rotary engine 12 horse power, a very capital four-cylinder steam printing-machine, similar in construction to those used at the "Times" office, capable of printing from 4 to 5,000 per hour; powerful planing and boring machine, capable of planing 16 feet by 4 feet 3, by Fox; nut-shaping machine by Nasmyth; two capital screw-cutting machines; boring machine with bar and two sets rings, capable of boring 80 horse power cylinders; 12 engine turning lathes from 8 feet to 30 feet long; 20 cwt. steel tools in bits, stocks, taps, and dies, &c.; 200 feet shafting, 200 rigger and pulley wheels, three steam boilers, cranes and chains, force-pumps, a five-ton crane, the fittings of smiths' shops, six tons top, bottom, and smiths' tools, 10 tons iron, two tons chain slings, 30 vices and benches, two new five-feet grindstones, five tons cast-iron, drawing tables, mahogany desks, scales and weights, also a large quantity of valuable patterns, and numerous other effects. To be viewed on Friday and Saturday previous to the sale when catalogues may be had on the premises, and of Mr. Fuller, Billiter-street, City.

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To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

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To Engineers and Others.

BY MR. FULLER, on Monday, Feb. 22nd, at 11, on the Premises, Paradise-row, Gravel-lane, Southwark, by direction of Mr. Lloyd, retiring from business, Pair of 45 Horse-power Condensing steam Marine Beam Engines, with Cast-iron Cylinders 36 inches diameter, 42-inch Stroke, Wrought-iron Shafts, Paddle-wheels, &c., made by the "Butterly Iron Company." To be viewed on Friday and Saturday previous to the Sale, when Catalogues may be had on the Premises, and of Mr. Fuller, 13, Billiter-street, City.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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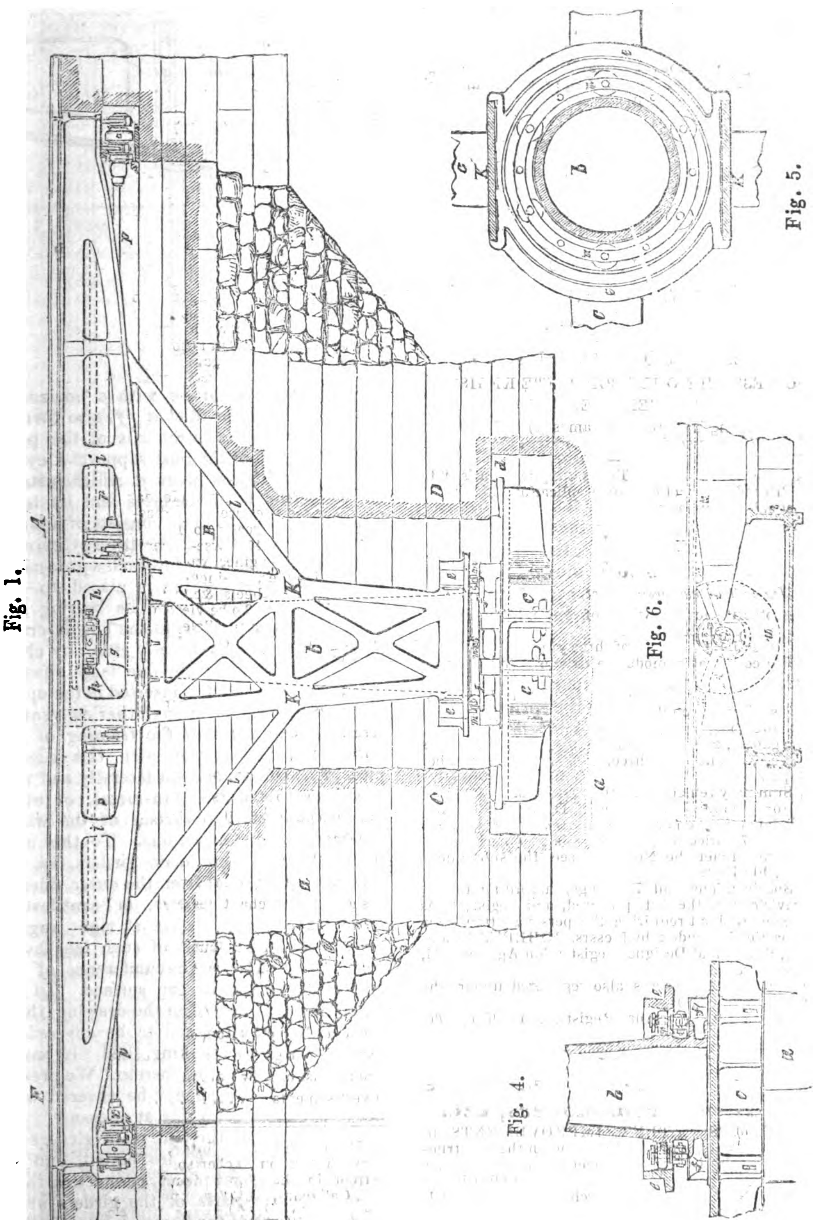
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1227.] SATURDAY, FEBRUARY 13. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

MESSRS. MALLET AND DAWSON'S NEW RAILWAY TURN-TABLE.



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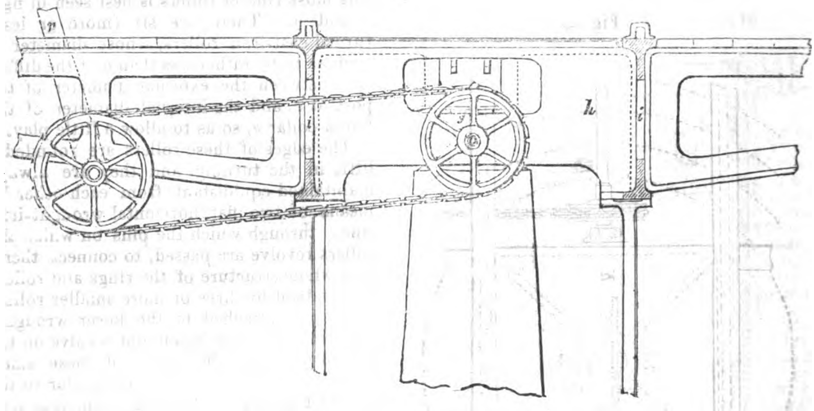
MESSRS. MALLET AND DAWSON'S NEW RAILWAY TURN-TABLE.

[Patent dated July 30, 1846; Specification enrolled January 30, 1847.

Fig. 3.



THE principal objects which Messrs. Mallet and Dawson have aimed at in the construction of the present table, and which are all, to a greater or less extent realized, have been—*First*, to make the principal parts of the table adjustable, independently of the masonry to which it is secured; *second*, that the centre of gravity of the whole movable structure shall be kept as much as possible below the point of support upon which it revolves; *third*, that the table shall be capable of support at the edge or periphery at any point of its revolution, and that this support may be promptly applied or withdrawn. And, *fourth*, that the friction and resistances to motion shall be reduced to the utmost possible degree consistent with strength and rigidity.

Fig. 1 represents a sectional elevation of a turn-table constructed on these principles; fig. 2, a plan thereof on the level of the rails; fig. 3, a section on the line A B of fig. 1. Fig. 4 is a vertical section through the centre-post; fig. 5, a section on the line C D of fig. 1; and fig. 6 is a section on the line E F; *a a* are parts of the masonry foundation; *b* is the centre-post, round and upon which the whole revolves; it is made of cast iron, and hollow, and is bolted at bottom to a large four-armed cross frame, *c*, imbedded in the masonry, the extremities of the arms of which are firmly wedged with hard wood inserted into four or more recesses prepared to receive them at the bottom of the sides of the well of masonry, as at *d d*. The lower end of the post *b* has a cylindrical-turned part at the level of *e e*, with a horizontal projecting bench or fillet at *ff*, also turned, and at right angles to the axis of the post. The upper end of the post supports a cylindrical wrought-iron pivot, *g*, which sustains the whole weight of the table and its load. The framing of the table consists of a large, square, central, casting, *h*, with a cylindrical box in the centre of it, in which a gun-metal or other suitable bearing is placed, to rest upon the top pivot, *g*. The bearing last mentioned is adjustable in the box laterally by set screws, and vertically either by chase wedges, as shown, or by one large square-threaded screw and nut, inserted in the upper end of the box, or in any other convenient way. As all parts of the framing of the table are in connection with this central piece, (*h*,) the adjustment laterally and vertically of this central gun-metal, or other bearing, adjusts the surface of the whole table in the same directions. To this central casting (*h*) two main girders, *i i*, are bolted at either side, from the outer sides of which other half girders, or cantilevers, secured by bolting, project at right angles, being made respectively of such lengths as to meet the circle or circumference of the table, and support its top surface. In the turn-table represented in the drawing, these half girders are supposed to be covered at top with timber planking, laid diagonally across them, and bolted thereto. We prefer, however, that they should be covered with cast-iron plates, movable at pleasure. To the lower edge of the two main girders *i i*, the two frames, *k k*, are bolted, and secured with diagonal pieces, connecting them with the outer parts of the girders at *l l*. The lower part of the frames *k k* are formed

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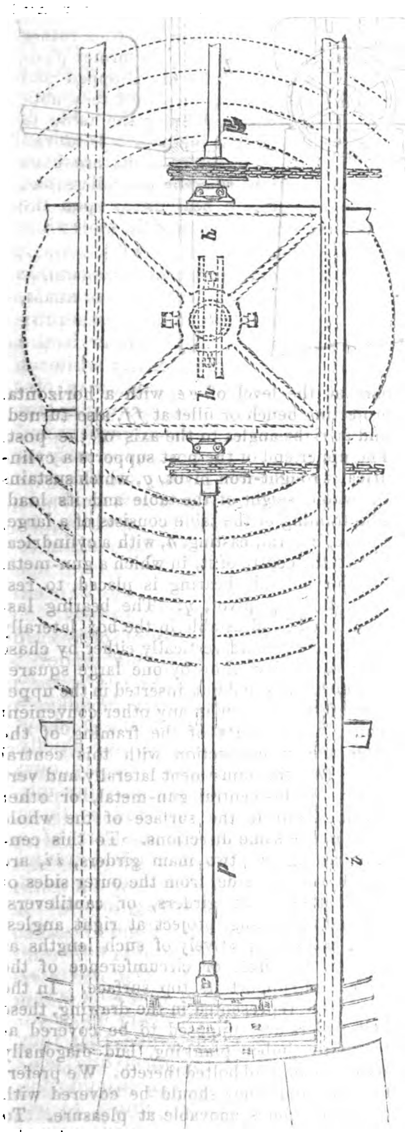
to receive the bottom hollow collar, *e e*, which is dropped down over the post. This collar is bored cylindrically internally, and is of such diameter that a space of some inches

Fig. 2.



is left all round betwixt it and the turned collar at bottom of the post *b*. Into this space the traversing-ring of the friction-rollers, *m*, fits. Any lateral strain produced by unequal loading of the table, is transmitted from the collar *e* through these rollers to the post *b*. The construction of this loose ring of rollers is best seen in figs. 4 and 5. There are six (more or less) turned cast-iron rollers, whose diameter is such as to be rather less than half the difference between the external diameter of the post at *e*, and the internal diameter of the bored collar *e*, so as to allow a little play.

The edges of these rollers are rounded a little in the turning, and they are always maintained equidistant from each other by means of two flat horizontal wrought-iron rings, through which the pins on which the rollers revolve are passed, to connect them. The whole structure of the rings and rollers is sustained by three or more smaller rollers which are attached to the lower wrought-iron ring, and rest upon and revolve on the turned fillet, *f f*. The axles of these small rollers are radial, and perpendicular to the axis of the post, *b*. When the table is caused to revolve, this loose collar of rollers revolves also, but not to the same extent; and removes in great part the friction otherwise encountered by the bottom bearing of al turn-tables which revolve upon a fixed vertical post. Between the outer ends of the main girders, *i i*, cross framing, *n n*, is secured and provided with proper bearings to receive the horizontal shafts, *p p*, which are radial to the post *b*, and turn freely in all their bearings. *o o*, are cast-iron rollers turned and bored concentrically, which are free to turn upon the shafts, *p p*, and are placed between the framing, *n n*. The portions of the shafts, *p p*, upon which the rollers, *o o*, revolve, are eccentrics, that is to say, the axis of the cylinder forming the portion of the shaft *p*, which is within the roller *o*, does not coincide with the axis of all other parts of the shaft, but is eccentric to the said axis, although the axes of all parts of the shafts are parallel. The inner ends of the shafts *p p* are provided with chain wheels, or with cranks, or with toothed wheels, or any other equivalent arrangement, by means of which a revolution either backwards or forwards, to the extent of half a circle, may be simultaneously given to the shaft, *p p*, by the movement of the hand lever, *r*, fig. 3, and the combination is so adjusted that when the lever, *r*, is at one extremity of the circular arc in which it moves, the eccentric parts of the shafts, *p p*, within the rollers, are turned downwards, and when it is at the opposite extremity of its arc these eccentrics are turned upwards, as shown in fig. 6, where one of the eccentrics and rollers is shown as thrown down, and their position when thrown up is also indicated by dotted lines. A horizontal traverse-ring of cast iron resting

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upon a bench of masonry, and adjustable as to level, &c., all round, is provided beneath the rollers, *o o*, and suited to the circle they describe with the table. When the eccentric parts of the shafts, *p p*, are thrown down, the rollers, *o o*, bear hard upon the upper face of this traverse ring, and in this position firmly support the outer edge of the turn-table, while they permit it freely to turn. When, however, the eccentric parts of the shafts, *p p*, are thrown up, the effect is to lift the rollers, *o o*, vertically off the traverse-ring, *s*, by a height equal to twice the distance between the axis of the eccentric portions, and that of the other portions of the shafts, *p p*, and in this state the turn-table rests only upon the central pivot, *g*, and, being prevented from oscillating by the bearing collar and rollers at *e*, is free to revolve either alone or with its load. It being farther requisite to provide means for stopping the revolution of the turn-table at any given point, the shafts, *p p*, have for this purpose palls, *t t*, attached to them, one at each outer end, close to the rollers, *o o*, these palls turning loosely upon the shafts, and those at the opposite ends of the shafts being turned towards opposite sides of the diameter of the table. The traverse-ring, *s*, is provided with stops of a wedge shape, as at *w w*, which are adjusted to receive these palls, and are placed at the requisite points, so that when the palls abut against these at the same moment, they shall bring the table to rest without any shock upon the central pivot. The stops, *w w*, are separate from the traverse-ring, in order that they may be altered in position at pleasure, and are secured to it, when fixed, by bolts, or in any other convenient way. A cast-iron boss, *x*, is keyed upon the shafts *p p*, close to the pall at either end; a portion of the circumference of this boss is cut away at the side next the pall; and a pin projects from the side of the eye of the pall into the quadrantal space so cut away. The effect of this arrangement is, that when the rollers *o o* are thrown down, or come into their bearing position, the palls also are freely at liberty to drop into the stops *w w*, set to receive them, but when the rollers *o o* are thrown up, (as already described by the eccentrics,) the palls are also lifted, so that the table may be caused to revolve to any extent without being stopped by dropping into any of the stops, as *w w*, however numerous these may be. The operation of the table requires but little farther explanation. Supposing the table to be at rest, and the rollers, *o o*, bearing upon the traverse-ring, *s*, and the palls, *t t'*, against their stops, the locomotive engine, or other load, is then brought in upon the rails which are secured on the surface of the table. The lever *r* is now caused to move through its full arc. The palls are lifted nearly into a horizontal position, and the rollers, *o o*, are lifted clear of the traverse-ring. The table is now caused to rotate as far as desired, and when it comes within two or three feet (at its circumference) of the point at which it is to stop, the lever *r* is moved back rather more than half way towards its former position, by which the palls are dropped and trail along the traverse-ring until they abut against their stops, and bring the table to rest, at which moment the lever *r* is moved on through the remainder of its arc back to its first position, whereby the rollers, *o o*, are brought again to bear firmly upon the ring *s*, to support the edge of the table while the load is being rolled off from it.

The same combination of a concentric roller turning loose upon an axle or shaft, having an eccentric motion, whereby motion may be given to the roller in the direction of its radius, either while at rest or while it is revolving, may obviously be applied with more or less advantage to various sorts of machinery. And it is therefore specified, not only as forming a prominent part of this improved turn-table; but as a new mechanical movement, to the use of which, in all its applications, the patentees claim to have an exclusive title.

SUGGESTIONS TOWARDS A DYNAMICAL THEORY OF GALVANIC ACTION.

Sir,—At the very outset of my remarks, I must request the reader to remember that what I have to offer is merely a few *hints*, unaccompanied by any new facts, and thrown out chiefly with the hope that what in my own hands is bare and barren, may possibly acquire value when possessed by those whose experimental pursuits are of a nature to make such theoretical ground "yield fruit," if capable of doing so at all. Dumas, in his extremely interesting work—*Leçons sur la Philosophie Chimique*, has said—"En chimie, nos théories sont des bequilles; *pour montrer qu'elles sont bonnes, il faut s'en servir et marcher.*"—"In chemistry our theories are *crutches;* to prove that they are good, *we must use them and walk with them.*" M. Dumas would not, however, object, I should think, to one crippled "sçavant" lending his pair of crutches to another, when he himself was either unable or prevented from using them. It unfortunately happens that "theories" are still "cheaper" than

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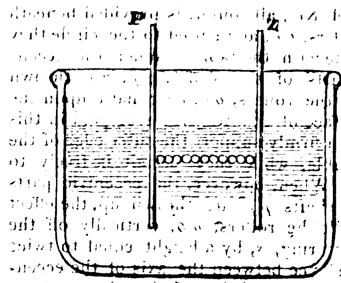
the "wooden legs" alluded to by facetious boys in their advice to the said cripples.

It is acknowledged, I believe, by all the most able writers and experimenters on this subject, that its present state is rather such as to show the inaccuracy, or at any rate deficiency, of all theories hitherto proposed, than to indicate the real view to be taken. The hypothesis of two fluids has fallen by degrees into its deserved neglect as a *physical explanation*, however useful it may be in leading to mathematical measurement in the case of statical electricity. Every thinking reader of the common works on electricity, must have seen that it was not only an assumption, but one requiring an innumerable crowd of auxiliary assumptions to make it applicable in various circumstances. Like the Ptolemaic theory in astronomy, it might serve (and usefully too) to connect into something like a common principle the straggling facts; but at every fresh discovery of *facts*, the machinery becomes more complicated—the true indication of weakness and falsity in every theory of which this can be said.

As the explanation of every phenomenon must consist in the comparison with more familiar facts, and as in these the only varying characteristics which we can discover are different kinds of motion and different *intensities* in the same kind of motion, the ultimate state of every explanation is the statement of the *manner* in which certain masses of matter move, and the *laws* of that motion. Thus astronomy is a statement that certain masses of matter, viz. the planets, &c., move in certain curves, and that, when all disturbing causes are removed, two such masses move towards each other four times as fast at any distance as they do at twice that distance, the disturbing causes being themselves nothing more than the necessary consequence of this law when a third, fourth, &c., mass of matter is taken into the account.

I shall then assume nothing, except that the particles of matter which are employed to produce the various effects denominated electrical, voltaic, &c., are *in motion* whilst so employed. Starting with this, I shall offer simply a series of queries, not as believing implicitly in the actual existence of the precise kind of action suggested, but as indicating merely a probable action of a similar nature.



1. Taking the common figure used to *illustrate* electrolytic action, where Z is a zinc plate, and P a platinum plate immersed in acid water; and supposing the small circles to represent a row of fluid molecules between the plates. In the first place, every one knows that in order to obtain the most "powerful" effects, we must take one plate, as Z, of a material having the greatest chemical attraction for the acid, and for the other, as P, a material having the least attraction which we can get. Now, until P and Z are connected by some metallic or other conducting substance, there is no sign of voltaic action, (the materials being supposed pure.) Hence, on the one hand, chemical action alone is asserted to be the "cause" of voltaic action, and, on the other, the *contact* of *dissimilar* metals is considered the "cause." This controversy, which has continued from the days of Volta up to the present moment, and which seems likely to continue indefinitely, has shown the practical benefit of having a theory of some kind, however right or wrong, by the immense number of facts which have been added to the science in the contest by the rival experimenters.

Amidst the mass of conflicting opinions, some have very naturally conjectured that it is the old story over again,—

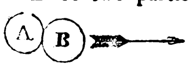
"Ye all are right, ye all are wrong."

Mr. Walker, the secretary of the Electrical Society, has given a sketch of what he terms the "Theory of Renewed Contact," which is, "that contact may be the prime cause of all electrical action, and that the current consequent on chemical action is merely the result of a succession of contacts, proceeding from the new particles which succeed the old as they are successively combined."

2. May not something like the following be the motion which goes on? The

attraction of a particle of zinc for the oxygen of the adjacent particle of fluid, brings it not only up to its own position, (or, if the particle of zinc moves as well, up to the centre of gravity of the two,) but as in every other case of such motions, beyond the position of equilibrium, thus inducing a state of vibration, precisely analogous to that of a pendulum, only which may be considered, for the sake of simplicity, as taking place in straight lines. This vibration being communicated along the line of fluid particles to the platinum, is there received by the platinum particles, and finally transmitted to the surrounding air. Now if a more speedy communication be opened between the platinum and zinc plates than that afforded by the atmosphere—as a metallic wire, for instance—the vibration we have mentioned is no longer slowly dissipated through the air, but communicated (with that rapidity which is known to characterize all such modes of communicating motion) to the zinc particles, so as to *increase* their original impetus up to a certain limit, and then keep it up at the same rate so long as the conditions remain the same as at first. If this be a true account of the action, the "philosophy" of the whole affair may be simply described thus:—"Voltaic apparatus enables us to *catch* and *turn to use* that power (motion) originated by chemical attraction, and which otherwise would have been communicated to the surrounding atmosphere, and *wasted*." This, of course, is of necessity a mere outline of the general nature of such an action. The various circumstances, such as the electrolytic effects, &c., remain to be considered, for which purpose it is necessary to have some more precise notions of the motion of two or more particles moving together. When any number are taken, however, the investigation becomes extremely difficult.

Let A and B be two particles, whose



masses we may call A and B: whilst in contact, let an impulse, P, be applied to both in the same direction. Then A will begin to move with a velocity proportional to $\frac{P}{A}$, and B with a velocity proportional to $\frac{P}{B}$. If the mass of B is greater than that of A, it will move slower than A would, and the particles will remain in contact. If B is less than A, it will move off faster than A can follow it, and they will separate.

Conceive now A and B to represent a particle of oxygen and a particle of hydrogen, which, together, form one particle of water. Let the force acting be an attractive one, as, for example, that of a particle of zinc. It is thus understood how separation may ensue when two particles in contact are *both* attracted by another particle. Suppose, in the figure, A to represent the hydrogen particle; on the other side we may suppose an adjacent particle of oxygen, thus: when

B moves off and leaves (A), C also being at the same time more powerfully attracted than A, will overtake it, coalesce with it, forming a particle of water; and so the series of decompositions and recompositions may go on throughout any line of fluid molecules. These decompositions, &c., may take place either in consequence solely of a difference between the *masses* of A and B, the *attractive force being the same on each*, or in consequence of the attractive force being different on the two. It may be found ultimately that the only difference between the chemical attraction (or affinity, as it is called) of substances is dependent on this difference of *mass;* but so far as this explanation is concerned, it is sufficient to know that the motions of A and B will be different: in common phraseology, the affinity of zinc for oxygen is greater than for hydrogen.

When, then, B has moved up to the particle of zinc, the two will form a compound particle of "oxide of zinc." If pure water is the fluid used, this oxide remains as it is, the same process taking place over the whole surface of the zinc plate, very soon leaves no pure zinc left. And as oxide of zinc has no attractive or decomposing force on the particles of water, of course the whole action is stopt. Hence, in every form of the battery, the first object is to get rid of this oxide; and this is done by acidulating the water. Sulphuric acid, for instance, combines with the oxide of zinc, forms the sulphate of zinc, and this being removed, leaves a fresh surface of pure zinc to renew the chemical attraction.

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We have now to consider what takes place at the platinum plate, and to show how this theory will apply to the known laws, viz. that for this plate we must select a material having the smallest attraction for oxygen, and that the hydrogen is given off at its surface.

(*To be continued.*)

STRICTURES ON MR. GROVE'S LECTURE ON HEAT.

Sir,—I attended the other night a lecture given by Mr. Grove at the Royal Institution on the subject of heat, and confess I was much disappointed. I had understood that he was a young man who had attained, or, at least, promised to attain, some eminence in science, and certainly as an experimenter he has some good claims to a scientific reputation; but in his lecture he disclosed higher views than these—he spoke rather contemptuously of experiments, in comparison at least with his theoretical cogitations; in short, he assumed the air and the pretensions of a philosopher, without appearing to have imbibed an iota of the spirit of philosophy. The unbecoming magisterial tone which pervaded nearly the whole of the lecture, seemed to have been inspired by his having propounded a new "dynamical" theory of heat, as he termed it—a theory not of its laws and operations, be it observed, which would alone deserve the name of a theory, but of its origin and nature, as consisting in the notion of a body being arrested in respect to its mass and transferred to its molecules — perhaps he would say to its atoms. It is not my purpose to examine this theory as to its being probable or otherwise. I would merely observe that it is only another guess (for it does not amount to, nor therefore deserve the name of a hypothesis,) added to the many that have been made to aid our conceptions of an agency, which, in the present state of our knowledge, is absolutely inscrutable in reference to its essential nature. And it is because the subject is removed so far back in the series of causes, and scarcely as yet come within the ken of philosophy, that the phenomena related to it can be cited in accordance with almost any guess that may be ventured upon in reference to it. Accordingly Mr. Grove brought forward his facts and experiments with a *bonâ fide* conviction, apparently, that they were not as applicable to other people's notions as to his own, and under an idea, entertained with great self-complacency, that he was enacting the part of an inductive philosopher, after the most approved Baconian method. The mischief of substituting in this manner the parade for the substance of knowledge is, that it confuses our ideas of what is legitimate investigation, and leads to a false estimate of scientific merit.

The circumstance, however, that has alone called for these animadversions on Mr. Grove's lecture was, that in clearing the ground for the reception of his own views, he chose to cast ridicule on Dr. Black's ideas of latent heat. Mr. Grove may be well assured—although his own modesty may fail to remind him of it—that Dr. Black was too sound a philosopher to say anything which should excite the ridicule of so young a student as himself. It discovers his own want of mental qualifications for philosophical investigation, if he cannot distinguish between what is latent and what is inoperative, and shows his presumption as a critic if he charges his own confusion of ideas upon the doctrine he impugns. Can he not perceive that an agent may be at work without giving any sensible manifestation of its presence? It may then be said to be latent, that is, hid or concealed, in distinction from being inert, and in contradistinction from the state in which it gives the usual sensible signs of its existence. There is no absurdity to those who can discriminate, in assigning a latent existence, and a course of what is then termed *silent* operations to the same body at the same time. Of course its operations are different, but because it ceases to exhibit those by which it is usually recognised we say it is in a latent state, concealed from our view for a time, but ready to resume its action when circumstances permit, and we do not by the expression negative the idea that in the mean time it may be acting in another direction. What better term could Dr. Black have employed to express the facts observed in his experiments apart from any theory? This latency of caloric is as much a fact as its power of giving the sensation of heat, or its power of expanding bodies, for it simply denotes the cessation, under certain circumstances,

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of any increase in the intensity of these powers, notwithstanding successive increments of the calorific force. There is no hypothesis here concerning either its nature or its mode of operation, and yet Mr. Grove facetiously assured us that he did not combat facts, but hypotheses. It is difficult to imagine what ideas he could attach to latent heat when there is wanted a something to fight against, and it is desirable that the contest should not be too hard,—a chimera is as convenient as anything.

I am, Sir, yours, &c.,

C.

THE PADDLE AND SCREW.

Sir,—It was my intention to have completed the course of argument on which I had entered, for the purpose of showing where the screw had failed to realize the same effect as the paddle, so far as it has yet been tried. But the appearance of some "advantages" of the screw, put forth by your correspondent "T. W.," has drawn me rather prematurely towards that side of the question. Seeing that his ideas are honest; and are, to a certain extent, the same as my own; or, to use his own expression, there is, in what he states, "some corn with only its usual allowance of chaff."

The "advantages" he sets forth, I take as they stand, making my remarks as I proceed, for and against the screw:

First, The submersion of the screw out of harm's way in action.—Yes; unless in a sea way, for then the screw is at times partly out of the water, and a good target. There is this further to be observed, that if it is damaged, or knocked away, the ship is no longer a steamer, and the chances are, that, in trying to hit the screw, the rudder may not escape—which would be rather awkward. Now, one paddle-wheel may be entirely disabled, but the ship is still a steamer, to a certain extent, for there are two wheels; and if a steamer will steam ten knots with two, she will go eight, or something better, with one. It must be an unlucky shot that will disable a paddle-wheel at once, it may knock away two or three paddle-boards and arms, but never mind; the wheel is of some use,—not so the screw: for if a shot *once* strikes it, it is done, it will break, or will be so thrown out of track, that it will not work, or, if it does, perhaps the ship's bottom will suffer. I have seen this in a screw-steamer, where a buoy got foul of it, the thread of the screw was twisted to a greater angle than the opening in the dead wood would admit of, without being cut away, which the screw did in style, carrying with it copper and all. But, to sum up with something like "Justice," the screw *has* the advantage over the paddle in this particular.

Second, The facility it affords for placing the engines and boilers in comparative safety under the circumstances.—The whole of this I will grant for the screw, with something more than is claimed. The weights are much lower, indeed all may be some feet below the water-line: and, which is of far greater importance, *the whole* is secured on the sleepers, or vessel's bottom, independent of the upper deck. I know of no greater claim the screw has than this. The defects of the naval steamers are becoming serious from this very cause; they break the entablatures of the engines in consequence of their being tied to the upper deck as well as to the vessel's bottom: and for paddle-engines it must be given up, that is to say, the engine must be less, or not dependent on the deck. I here allude to the direct engine. All vessels work more or less, the larger the ship the more in proportion, despite the increased scantling. The ill-fated *Sphynx* may be also taken as a case, her engine entablature being broken to pieces by being connected to the upper frame; thumping as she has done upon the rocks or sands, the vessel's bottom has been springing up, the deck comparatively not so, and, as a consequence, the parts between, that is, the engine, have suffered; supposing the engine to be saved! At this time the expense of repairing it may be stated to be 30 per cent. more over and above what it would have been, had the engine been independent of the deck. I trust it will not be considered out of place, indeed it cannot be, to show the "advantages" of the screw:

Third, Presenting a clear broadside and flush deck for the battery.—Granted. I will just say, *en passant,* that Sir Charles Napier's steam-ship, *Sidon,* has a main deck, merely having the guns in the wake of the paddle-boxes.

Fourth, Removing the paddle-boxes and top hamper, which hold almost as

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much wind, when head to it, as a main top-sail aback.—True; but despite this, wherever the screw has been tried head to it, the paddle has been the conqueror; and, at the same time, with considerably less power; and last, not least, with *less speed*.

Fifth, Its equable and regular strain whatever may be the rolling of the ship.—Yes, this is true; but, some how or other, screw vessels are very famous at rolling; and, to a certain extent, the screw suffers from it, but not so much as the paddle does. To make it clear, take an extreme case; Suppose the vessel on her broadside; here, it is clear, the vessel would no longer have the same immersion, and, as a consequence, part of the screw would be out of water, carrying round with it a quantity of air, and creating such a vortex in the water, that its fulcrum is destroyed. It is like endeavouring to cut a screw thread in a "saw pit," instead of in a deal plank. Now for some *more* "advantages" the screw has over the paddle:

First, In case of the screw, or the machinery, being disabled, the ship is more a sailing vessel, that is, more independent of her steam power. The opening in the deadwood may be considered to affect the steerage, seeing that it is the same as if a portion of the stern-post were taken away, for every sailor and ship-builder knows what part the stern-post plays in the steerage of the ship. For as the ship's stern swings round from the obliquity of the rudder, the water must pass through the opening, and thus, to a certain extent, neutralize the effect of the rudder. This may be overdrawn, but I started with the intention of putting before *your* readers, *all* that I knew of the paddle or screw; and it is for them to investigate, whether such is the effect, and if it is likely to interfere with the vessel's staying in light winds, more especially when under canvass, and not using steam power. My idea is, it will very materially affect the steerage.

Second, The vessel may use her canvas with greater advantage than the paddle vessel. The vessel heeling as she does, more or less, there is a limit to the revolutions of the wheel—more particularly if there is much sea—which becomes a drag upon the ship, that is, she would go faster without the steam power. I have seen this, which applies to every way you may have the wind; if it be dead aft, the seas flowing under the quarter, and, rising as it does about the paddle-wheel, gorges so with water, that the wheel is impeded. Not so the screw: here the engine can always get away, so that the velocity, or to speak more correctly, the speed of the screw will increase with the ship, and, in moving, will it be a drag upon her?

Third, Should the engine be at all defective; say, for instance, slides leaky, stuffing-boxes, joints, &c., the engines working up to nearly the same speed under every circumstance, the expansion is kept up, also its momentum, which is more effective than many are pleased to allow; whereas, with the paddle, when the vessel rolls, or is deeply laden, or any thing that may bring on increased load upon the engine, the speed is checked, giving more time (if there are any leaks about the engine) for the vacuum to be destroyed, and a great bore, as I before observed, of momentum.

Fourth, The being able to *use up* nearly all the power of the boiler when at times it is needed. In a paddle vessel, we are obliged to fit a second motion, or wheel work, to enable us to do this, but with the screw it is not wanted; acting as it (the screw) does, obliquely on the water, and not at right angles as the paddle, it moves through it with greater freedom; if I may express myself in this way, what it cannot do in *once* it does in *twice*. Let it be looked at in this way. Here is a certain weight to move; we employ an inclined plane (a screw if you please), whose angle is so much we cannot move it; and our common sense teaches us to take an inclined plane of a less angle, or, as Jack would say, "a finer wedge." We move the weight, but it is with *two* turns, or double the time for the space passed through, whereas *could* we have moved it with the inclined plane of *great* angle, it would have been done with one turn, or half the time. Here, then, we have a mechanical advantage, the screw enables the engine to give forth its powers.

Fifth, When simply disconnected, to sail, the screw will be found to offer less resistance to the ship than the paddle, more particularly if the wind is a-beam,

the lee wheel being perhaps immersed to the shaft, which causes the ship to make a great deal of lee-way.

Sixth, The advantage of the screw as an auxiliary. Here the screw reigns pre-eminent with a small power and a *large screw;* the greatest advantages both in our commercial and naval marine will accrue. The machinery takes up but little space, and having small power, the coal stowage will be but small; and to be used in calms and light winds, there is no doubt but it will pay for the space it takes up in the vessel.

I find, Mr. Editor, I shall not have space to enumerate any more of the screw's advantages, wishing to have something to say about the latter part of your correspondent's letter. He ("T. W.") goes on to say, "These are practical advantages Captain Halsted may certainly claim, and in theory," &c. "We know a screw is one of the greatest mechanical powers on shore, and I think the lever, as applied by the paddle, not so." I fully appreciate the *value* of the screw, and any one conversant with mechanism must do the same. But it is a very different thing using a screw in a fluid, to what it is using it in a solid—one a yielding medium, the other not; and to purposes on shore, we employ any sort of screw, of any size—not so on shipboard. When I say shipboard, I mean as a mode of propulsion. We are limited to angle of screw, and also, which is of so much importance, to diameter, and in the latter does the secret of the thing lie. I am too sensible of the effect to be produced by a screw over a lever, if it could be employed in the way I could wish; but it is impossible, the build of a ship will not admit of it. If it were practicable to do so, and the build of the ship to admit of it, it would with less power, and under every circumstances, beat the paddle. But let me explain how this is to be done; but it is not possible. As your correspondent very justly says, "If a screw of large circumference were used, it would be found to answer better." Yes, and that circumference must, to be *equal* to the *paddle*, be increased considerably. To beat the paddle, the screw must be of that diameter and pitch (and the angle of the thread must not exceed 23 or 24 degrees), that with the number of revolutions of an ordinary constructed steam-engine, (not the engine twisted and altered to suit the screw, as it is,) its space passed over shall be something more than the speed of the ship. Say it is intended, if possible, to get 14 knots out of a ship, the screw should screw over about 15 knots, for with such a screw there would be but little slip. But such a screw could not be fitted, for to compare it as to size, it would be, say a steam ship, like the *Terrible*, of greater diameter than the paddle-wheel. So here we see that we are limited as to diameter of screw. To make the thing as simple as possible, there is a screw that could be put to one of the steam frigates that would absorb the power of the engine at the same velocity as it is usual now to work them; and it would pass over as great a space as the periphery of the paddle does; but where is such a screw to be worked? The deadwood will not admit of it, and even if it would, it is not the best place for it. To be equal to the paddle, it must be where the paddle is now fitted, 20 feet abaft the stern-post, or the same number of feet before the cut-water, and wholly immersed in either of these places. With the screw that I have named, then would the screw be equal, and would beat the paddle under every circumstances. Master Deadwood might then hold his tongue about steaming from A to B, the coal question would be at rest, for such a screw would *hold on* the ship, and would not have the accident of slip the present screw has when opposed to a gale; then the ship would stop for nothing,—light or laden—no matter—on she must go. But we know it is impossible to have such a screw; we are limited to diameter and angle of thread. We put in as large a screw as the build of the ship will allow, and place it in the deadwood, where it is not liable to injury; and to get anything like speed, out of the screw it must have a multiple, and away goes your power; and at any little increased resistance the vessel meets with, the screw, instead of holding the ship, slips. To get a clear idea of this, supposing the screw was only *one foot* in diameter, one can see that, it would not move the vessel. Now the power of the engines might be taken up, so balanced by such a screw;

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but the multiple must be very great. I *merely* say that it *is* possible: so what I want to show is, that, in using a small screw, we are approaching the exaggerated view taken. Now, the deadwood is not the best place, despite all that has been said about the after current. What is it worth? You have nothing but a series of eddies after all; and for the screw, the more solid the water is the better. Well, then, it is because we are tied down as we are, that we have not done so well under all circumstances with the screw as with the paddle. Whenever the screw is tried with the same power to tonnage as the paddle, it will be found that the paddle will have the best—more particularly head to it; for in no case yet has the paddle, where it has been tried against the screw, had the same advantages. You will perceive, Sir, that I am willing (taking the substance of this) to allow the screw a great deal, that is, to do it "justice." It has many advantages for general purposes of the paddle; but so far as it has yet been tried, *under steam* and under *every circumstance*, it is *not equal* to the paddle. My point is *equality* with the paddle which has been claimed for the screw; for I am too sensible of its advantages in a general way, and have always admitted them. My pen, Sir, would have been perhaps more rusty for want of use, did I not see that more is claimed for the screw than it deserves. Too much was claimed by the gallant captain; and, although entertaining the highest respect for his scientific attainments, also for the noble profession of which he is a member, I could not let it pass without throwing in my mite for the benefit of the public. And being now fairly started, whatever I may think of or stumble against, both for and against the screw or paddle, your readers shall have the benefit of. I write under an anonymous signature; but to me it matters not, nor can it to your readers, whether it be John Styles or Joe Snookes who signs; the information is equally valuable, and it is for your readers to investigate all that is written; and as your correspondent T.W. says—"sift the corn from the chaff." I took rather a serious signature; but I trust before I have done, it will be considered I have not trifled with the subject—that is, I trust your readers will give me credit for being something like an honest correspondent, or that my intention from the first was

JUSTICE.

EUCLID'S ELEMENTS OF GEOMETRY; THE FIRST SIX BOOKS. SCHOOL EDITION. BY ROBERT POTTS, M.A., TRINITY COLLEGE. PARKER, WEST STRAND.

About twelve months ago, we gave some notice of an octavo edition of Simson's Euclid, then recently published by Mr. Potts. We hailed the appearance of that volume as the practical commencement of a new era in the English history of geometry—as the dawn of a better taste in science, and the adoption of a better system in education. Upon this subject we shall hereafter enlarge in the completion of our remarks on the "Cambridge Graces" of May last; and it will be sufficient on the present occasion to congratulate Mr. Potts on the success of his labours, and the scientific public on the brighter intellectual prospects which that success implies.

The octavo edition, convenient as it is for private and university students, is too large and too expensive for a general school-book; and the editor has, (wisely we think, and beneficially we are certain,) printed the most important parts of that volume in a smaller form, and at less than half the price of the other. It comprises the whole of the larger volume, except the eleventh and twelfth books and the exercises upon them—with a very few of the more recondite notes and the most difficult of the exercises omitted. We hope, therefore, to see this work very generally introduced into private scholastic establishments, as it already is into the public schools of Eton, Harrow, Christ's Hospital, King's College, (London,) the Clergy Orphan School, and the Royal Military Academy, (Woolwich.) We can most conscientiously recommend it to our own younger readers as the *best* edition of the *best* book on geometry, with which we are acquainted; and that, too, whether they be solitary readers, or class-students associated for mutual improvement.

With respect to the treatment of "planes

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and solids" by Euclid, we have already expressed our opinion in the *Miscellanea Mathematica*, No. xiv., (vol. xiv., p. 484,) and it will follow, that if our estimate of that portion of the writings of the illustrious Greek be correct, their omission from this edition of the "Elements" will be no disadvantage to the reader.

We owe to Mr. Potts an *amende* for one of the remarks made in our notice of his larger edition (vol. xliv., p. 140;) viz., our inference from the style of his chapter on geometrical analysis, that the *subject* must have been "got up" for the occasion. We may, perhaps, be somewhat fastidious respecting treatises on this subject, as it has engaged much of our thoughts; and it is a fact, that we have never met with a treatise in which we think the philosophy of the Greek geometry has been fairly developed. We ought not to have blamed Mr. Potts for not doing what few before have attempted to do; and in which no one, as we conceive, has entirely succeeded. A more careful analysis of the short chapter in question has convinced us that the original MS. had been a good and original treatise, but which has been "cut down" by the author—perhaps from the necessity imposed upon him by the unanticipated extent to which the work had expanded itself in printing. Although this chapter may be quite sufficient for the smaller edition of his Euclid, we would urge upon him the advantage, and the necessity too, of his very considerably extending this chapter in the next edition of the larger volume.

As to his not mentioning the non-academic geometers of England, it is the *fashion* of his university; and his doing so might have been deemed an eccentricity scarcely less to be tolerated, than if he had marched into his college in regimental uniform, or appeared in chapel attired *à la Louis Quatorze*. But this spirit is on the wane, we are happy to say, even at Cambridge; and we look to Mr. Potts being one day able to give due credit to English mathematicians, not only without the risk of being "sent to Coventry," but without rebuke or contempt. Nay, more, we look to the frank and manly spirit which could place itself in the van of a movement which was then unpopular in the university, to render justice to English intellect, irrespective of all consequences and considerations whatever. We place every reliance upon Mr. Potts that he will do the justice which is necessary in a future edition of the larger work—in that which contains the history of pure geometry.

That our judgment of Mr. Potts's labour has not been prejudiced by what was probably an *unintentional* slight of the class of men amongst whom we rank ourselves, will be apparent from the earnest manner in which we recommend the present edition to our readers. We should, indeed, betray the trust imposed upon us by our position, were we to allow personal, or class-feeling to drive us into hostility against the author of a good book—and this, Potts's edition of Euclid, assuredly is.

No sooner had the success of Mr. Potts's work become certain, by the passing of the "Grace" of May 13, than a certain reverend Cantab, of the name of Colenso, "set about" an edition of Euclid—no doubt relying upon the support of those schools in which his (Mr. Colenso's) algebra had been already introduced, for superseding that of Mr. Potts. We do not in the slightest degree dispute the right of any man to publish an edition of Euclid's Elements at any time; and therefore do not object to this in itself—although it does not appear a friendly act on the part of one collegian towards another. What we censure is—that the immense collection of exercises that Mr. Potts had made *were unscrupulously adopted by Mr. Colenso*. We have, ourselves, had some experience in the collection of problems from miscellaneous works and papers, and we know the cost of time and the weariness of mind produced by it; and we cannot suppose that this collection had been made by Mr. Potts without the most unwearied assiduity, and at the cost of immense labour. He had, moreover, not only candidly acknowledged the sources from which they had been obtained, but had also given distinct references

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to the places in which every one of them may be found. Mr. Colenso, therefore, could adopt them without rendering himself *legally* amenable as a *pirate*. We do not denounce such conduct without having assured ourselves, as far as moral assurance can go, that such conduct has been pursued in this instance; for we have compared large portions of the *exercises* in the two editions, and *most carefully*, those to two of the books; and we find in them all, and in those two especially, irrefragable proofs that Mr. Colenso's exercises are taken *directly* from those in Mr. Potts's work. No one who has examined the two works can bring himself to believe even in the *possibility* of our being mistaken as to the conduct of Mr. Colenso. We are glad to learn, however, for the honour of Cambridge, that such wholesale pillage of another man's labours is condemned throughout the university. Though he is safe in law, he is yet amenable to public opinion, and the public opinion of his own class has been decisively expressed on this matter. To public opinion—to the detestation of all honourable men—we leave such doings.

We must avail ourselves also of the present occasion, to denounce a system which has been growing up for years in Cambridge, and which has recently become so flagrant, as to destroy all confidence in the honour of scientific elementary writers. We do not specifically refer to the system of so many men writing ephemeral treatises, whose only merit and whose only chance of sale, arise from the author being a college tutor; though this, from the trashy matter of the great bulk of them, is derogatory to the character of the university, and peculiarly vexatious to the non-academic purchasers of such works. We refer—and we do it with loathing—to the translations of foreign works being put forth as new treatises by Cambridge men, and to the similar appropriations of even English works, with merely colourable variations or the slightest imaginable changes. We should feel it dishonourable to make such a charge without at the same time giving specific references to justify ourselves. Dr. Hymers, Mr. Snowball, Mr. Cape, (and others in a less degree,) as well as Mr. Colenso, are included in this charge. Dr. Hymers has printed a mere, (and *almost literal*) translation of De Fourcy's "Trigonometry" without a preface, and with his own name *alone* on the title page. Again, with only an introduction and one or two propositions slightly varied from the original, the doctor has republished Maddy's "Astronomy" *as his own work!* Mr. Snowball, under the shelter of Dr. Wood's name, published a treatise on mechanics, the pages of which only need to be turned over, to ensure a conviction of the truth of Dr. Whewell's complaint, that it is almost entirely pirated from him; and that work *now* appears with Mr. Snowball's name on the face of it! Mr. Cape's treatise on military affairs, in the second volume of his "Course of Mathematics," is only a slightly varied recomposition of Dr. Hutton's chapters on the same subject; and yet this work, *for the sake of these topics*, is now introduced into the Woolwich Academy as a substitute for the original Hutton—which was expelled from that institution seven years ago by the influence of another Cambridge man! We have heard, too, that poor De Fourcy is, also, to be pillaged of his treatise on "Descriptive Geometry", much in the same manner that Dr. Hymers has despoiled him of the reputation of composing his "Trigonometry;" *mais nous verrons!* Mr. Colenso, therefore, is not without company or precedent,—such as it is; but *we*, at least, will never be deterred from exposing such practices to the scorn of all honest men, be their perpetrators who or what they may.

Postscript.—Since the preceding notice was written, we have seen another "artful dodge" (as Dickens calls such petty manœuvres) on the part of the Reverend Mr. Colenso. Mr. Potts had announced his intention of publishing a series of "Hints for Solution" of the principal propositions which he had attached to his Euclid as exercises. Mr. Colenso, after making free with the exercises themselves, as already described, rushes into the book-market with

his own "Key to the Problems" before Mr. Potts. That *this* work, at least, is the production of Mr. Colenso and his friends, there can be no doubt; but we look upon such mercenary racing as unseemly in the man, and most unseemly in the Christian minister—especially in the clergyman who has obtained a lucrative benefice in the gift of his college. What becomes of his *spiritual flock* whilst he is scrambling in the world for a few additional guineas? We do not suppose, however, that such geometry as Mr. Colenso's will attract much attention, even amongst the under-graduates of Cambridge; for we will not so far insult their understandings as to believe they will thus drivel away their time, or fancy they are forming a good geometrical taste, by imitating such models as this work supplies. If Mr. Colenso do really possess any geometrical taste, talent, or learning, (which of course we do not pretend to know,) his indecent haste has been fatal to their development. He has fallen into his own pit. The disgust, however, which we feel, is at the *spirit* which such manœuvres imply;—at the low sense of *moral right and wrong* which such practices prove to prevail at Cambridge.

We shall presently have a little to say on a case of the same kind by a *new Cantab.* Where is all this to end? The character of the university *for everything like honour* is at stake!

AMERICAN EXPERIMENTS ON THE GUN-COTTON.

The following tabular statement shows the results of the comparative trials made yesterday, at this arsenal, with rifle powder, and a sample of the *gun-cotton* prepared by Professor Schönbein, and brought to this country by Mr. Robertson.

Experiments with the Musket Pendulum.

Kind of powder.	Charge.	Height of charge in the musket.	Initial velocity of the ball.	Remarks.
Dupont's rifle powder.	Grs. 120 60	Inches. 1.8 1.25	Feet. 1,531 1,062	Mean of three rounds. Ditto.
Gun-cotton.	30 60 60 50	1.6 1.8 2.5 2.6	971 1,426 1,567 1,489	Charge rammed slightly, after the ball was inserted; some of the cotton was expelled unburnt.

The quantity of cotton offered for trial was too small to admit of a repetition of the experiments. The above results are, therefore, to be regarded as only approximative. To give a fair indication of the force of this new explosive substance, it would be necessary to make experiments as to the best mode of using it in the gun, especially with regard to the proper degree of compression by ramming. A comparison of the results of the two charges of 60 grains, shows, as might be anticipated, a marked variation produced by different degrees of compression. The ball and wad occupying, in every case, a height of about three-quarters of an inch, the space occupied by the cotton or the gunpowder may be deduced from the height of the charge given in the table.

From these trials the gun-cotton seems to produce, in the musket, an effect equal to about twice its weight of good rifle powder. This cotton leaves a small quantity of a dark-coloured residuum in the musket barrel, extending from the breech to about half the length of the barrel; this residuum is easily removed by wiping the barrel with a rag. The combustion of the gun-cotton is unattended with smoke; the report made by it appeared to me sharper than that produced by gunpowder.

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It may be proper to add, that Mr. Robertson does not consider this sample of the gun-cotton to be of the best quality.

Respectfully, your obedient servant,

A. Mordecai,
Captain of Ordnance.

Lieut.-Col. Geo. Talcott,
Ordnance Department.

Washington Arsenal, Nov. 13, 1846.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 143.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

Thomas Delaval, of Seaton Delaval, (Northumberland,) esq.: specification for "a means of making kelp by burning the seaweed at all seasons of the year wet immediately after it is cut from the rocks or driven upon the shore, without any farther preparation." March 13 last past; April 9, 1767.

Thomas Long, of Mitcham, (Surry,) calico printer: specification for "a machine for the blotching, printing, intermixing, and variegating with copper plates, purple and red, and red and black colours, on calicoes, cottons, lawns, and all other kinds of whitstered linens for furniture, garments, and handkerchiefs." A paper schedule of drawings of the invention is attached. Feb. 25, 7 Geo. 3; June 17, 1767.

Alexander Brodie, of the parish of St. Clement Danes, (Middlesex,) gent.: specification enrolled pursuant to patent granted to the said *Alexander Brodie* and one *Richard Williams*, of the same parish, gent., for "a method of making fire stoves and registers, which will remedy all or most of the imperfections and inconveniences heretofore attending them with respect to heat and otherwise; and which register, with a little variation in its model, but still preserving the same principle, may be used apart from the stove and applied to other advantageous purposes" (viz., the bedsteads of invalids.) July 14, 7 Geo. 3; Oct. 29, 7 Geo. 3, 1767.

Christopher Battiscombe, of the parish of Yatton, (Somerset:) specification for "machines for preventing dangers which often attend persons falling from their horses by entangling their feet in the stirrup," Nov. 11, 8 Geo. 3; Dec. 22, 1767, 8 Geo. 3.

Joachim Smith, of the parish of St. Giles, (Middlesex,) gent.: specification for "a compound preparation which will effectually preserve the bottoms of ships and other vessels that use the sea from being eaten into or honeycombed by worms or other insects, and which will be more effectual than covering the ships' bottoms with filling nails or even copper." Dec. 18, 8 Geo. 3; April 15, 1768, 8 Geo. 3.

Richard Hayne, of Ashborne, (Derby,) esq.: specification for "a machine or mill so contracted and effectual that it may be set up and conveniently worked in any small room, and used as well for the grinding of wheat, corn, and other grain as in preparing of utensils and materials used in diverse manufactories and businesses." Dec. 24, 8 Geo. 3; April 16, 1768.

William Powers, of the city of Coventry, journeyman leather-dresser: specification for "a method of splitting and dividing sheeps' pelts, lamb pelts, and other skins, so as to render the grain or upper part thereof more useful for binding of books and other purposes of trade, and at the same time preserving the under part of the said pelts and skins in full goodness to be wrought into leather." April 16, 8 Geo. 3; May 17, 1768.

Christopher Pinchbeck, of Cockspur-st., in the parish of St. Martin-in-the-Fields, (Middlesex,) toyman and mechanician: specification for a nosle and candlestick of a different construction from anything, for the purpose of holding candles, now in use; contrived so as to keep the candle always in an upright position, though the candlestick be held out flat, and for rendering paper unnecessary in setting up the candle. Feb. 29, 8 Geo. 3; June 25, 1768, 8 Geo. 3.

Christopher Pinchbeck, of the parish of St. Martin-in-the-Fields, (Middlesex,) toyman and mechanician: specification for "a singular and useful set of tablets called the Nocturnal Remembrancer, whereby a person of genius, business, and reflection may secure all their night thoughts worth preserving, though totally in the dark." March 17, 8 Geo. 3; July 8, 1768, 8 Geo. 3.

Thomas Appleby, of Knutsford, (Chester,) surgeon: specification for "a balsam for the cure of and bringing away sand and gravel lodged in the bladder and kidneys, the cure of green wounds, and several other disorders." Aug. 13, 8 Geo. 3; Aug. 22, 8 Geo. 3, 1768.

Martin Brumby, of Gainsborough, (Lincoln,) sail cloth maker: specification for "a certain water or liquor for the tanning or preserving of single thread or double thread sail cloth made of yarn, which, by being laid, or boiled therein, is very beneficial in strengthening the yarn and preserving the sail cloth from mildewing and rotting," and which sail cloth so prepared is called tanned

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canvas. Nov. 28, 9 Geo. 3; Dec. 15, 9 Geo. 3, 1768.

George Whateley, of Birmingham, (Warwick,) plater of silver: specification for "a method of plating gold upon silver plated metal wire, and of drawing such wire when plated with gold, into wire of very fine sizes, both round, flat, and square, and of drawing the same so fine as to make thread, lace, fringe, and tinsel, and be as useful in various branches of business and manufactories as real gold wire thread, lace, fringe, and tinsel." Dec. 6, 9 Geo. 3; Feb. 6, 1769.

George Whateley, of Birmingham, (Warwick,) plater of silver: specification for a method of plating silver upon metal wire, and drawing the same into wire of very fine sizes, both round, flat, and square, and of drawing the same so fine as to make thread, lace, fringe, and tinsel, which will be as useful in various branches of business and manufactories as real silver wire thread; and also for a method of plating gold upon silver wire, and drawing the same into wire, &c. Nov. 8, 9 Geo. 3; Feb. 6, 1769.

Anthony Drummond, of Gateshead, (Durham,) mason: specification for "a machine or engine for polishing or planing of marble, flag stones, paving, and other stones," to be worked by horse, wind, or water. Oct. 28 last past; Jan. 27, 9 Geo. 3, 1769.

Humphry Jackson: specification for effectually toughening, hardening, or rendering very flexible, and preserving, wood and timber in general from speedy rotting and decay, particularly oak and elm plank, as well as the largest oak and elm timber used in buildings and constructing ships of war, &c.; likewise for defending the same against the worm; which art is particularly adapted to render wood the produce of America equal to the best wood the growth of Great Britain or foreign countries, in all their properties. Dec. 9, 9 Geo. 3; March 30, 1769, 9 Geo. 3.

Nathaniel Mason, of the parish of St. Botolph, Aldgate, London, gent.: specification pursuant to patent granted to *William James*, of Bank Buildings, (London,) gent., and the said *Nathaniel Mason*, for improvements in the wheel carriages of the coach kind, to wit, coach, chariot, landau, chaise, &c., which will give great ease to the cattle employed to draw the same. Jan. 19 last; April 11, 1769.

Joachim Smith, of the parish of St. Giles, (Middlesex,) gent.: specification for several kinds of candlesticks, sconces, and lamps, on a new principle, which will be of the greatest use to those that study, write, draw, or do any kind of needlework by night; by which contrivance the candle will burn more steadily, give a much stronger light, and may be carried about without guttering. Feb. 6, 9 Geo. 3; June 2, 1769, 9 Geo. 3.

Samuel Willday, of Atherston, (Warwick,) hat-maker: specification for "a new machine or instrument for drying malt with coal, or other the most gross and smoking fuel, without communicating any ill taste or flavour whatever to the malt." Feb. 21, 9 Geo 3; June 10, 1769, 9 Geo. 3.

Richard Arkwright, of the town of Nottingham, (Nottingham:) specification for "a new piece of machinery for the making of weft or yarn from cotton, flax, and wool." July 3, 9 Geo. 3; July 15, 1769, 9 Geo. 3.

John Ascough, of Nutwith Court, (York,) esq.: specification for "a machine or engine for manufacturing combs." March 22, 9 Geo. 3; July 8, 9 Geo. 3, 1769.

Samuel Ambrose, of Deptford, (Kent,) ironmonger: specification for a pump of a particular sort, which is worked by a roll or sheave placed in an aperture in the spear thereof, by which means the said spear is kept in a direction perpendicular to the chamber, in the simplest manner possible; also leavers suitable for large or small bores, so that the said pump may be worked either single or double handed with the greatest ease; also brass pistons and buckets, so that the fluid will ascend to the chamber, and may be drawn up with the greatest facility. May 5, 9 Geo. 3; Aug. 23, 1769, 9 Geo. 3.

Christopher Reeves, of Blackman-street, in the parish of St. Mary, Newington, (Surry,) coach and coach-harness maker: specification for "certain springs, whereby coaches and all other four-wheel carriages will go and travel with much greater ease as well in town as in country, than with any other spring or springs which have hitherto been invented or discovered, with the method of supporting the bodies of such carriages upon the said springs in the centre in such manner as will greatly conduce to prevent the overturning the same by almost any accident." June 8, 9 Geo. 3; Oct. 5, 1769, 9 Geo. 3.

Joseph Jacob, the younger, of St. Mary-Axe, in the city of London, coachmaker: specification for "A method for the better construction of wheel carriages, by the application of united spiral springs, hoop wheels, and leather boxes." July 13, 9 Geo. 3; Oct. 12, 1769, 9 Geo. 3.

Joseph de Mages, of the parish of St. Mary-le-Bow, (Middlesex:) specification pursuant to patent granted to the said *Joseph de Mages*, *John Baker*, of the parish of St. Martin, Colchester, baysmaker, and *John Cook*, of Allhallows, London-wall, (Middlesex,) for "A new improvement of making a sort of bays for the Spanish and

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Portugal trade, quite upon a new invention, imitating those manufactured in France, by which the French have had so considerable an advantage over the English manufactories." Nov. 7, 10 Geo. 3; Jan. 17, 1770, 10 Geo. 3.

Edward Bevan, of Air-street, Piccadilly, (Middlesex,) carpenter: specification for "Making a new constructed Venetian window blind." Dec. 11 last; March 14, 10 Geo. 3, 1770.

Richard Hornbuckle, of East Greenwich, (Kent,) mealman: specification for "An iron oven, movable at all times, to bake bread, or pies, or tarts, in the utmost perfection, and the bread as good as French rolls, which may be set in any room without danger of fire, and the expenses of firing to be used in baking will not exceed one penny an hour: also a stove the exact same form as the oven, movable instantly while in use to heat or air rooms and other places, which will give more heat with four times less fire than any other thing now used for such purpose, and is so safe from any danger of suffocating, that a person may be shut in the room, at the same time it is heated without the least inconvenience." Dec. 9, 10 Geo. 3; March 26, 10 Geo. 3, 1770.

Charles Le Rat, of Newman-street, in the parish of St. Mary-le-bone, (Middlesex,) surgeon: specification for "the poudre unique, of a particular effect, to purify the human blood, and cure the rheumatism, scurvy, jaundice, and all disorders arising from a foulness of blood. Dec. 23, 10 Geo. 3; April 18, 10 Geo. 3, 1770.

James Stuard, of the parish of St. John, Wapping, (Middlesex:) specification for "A windlass, on a new construction, to raise heavy weights on board ships or vessels, that is much superior to any machine now used for the weighing of anchors. March 15, 10 Geo. 3; July 11, 1770, 10 Geo. 3.

Robert Alsop, esq.: specification for "A new species, or kind of embroidery for cloths (to be manufactured in gold or silver on silk, riband and woollen, linen, cotton, or mohair,) to match any colour," called (by specifier) Loom Embroidery. March 22, 10 Geo. 3; July 19, 1770, 10 Geo. 3.

Thomas Harris, of the parish of St. Sepulchres, London, watchmaker: specification for "A new fancy watch, with an improvement on the pendulum and other parts of the work, in order to gain power and time:" the tides, age and change of moon, and day of month, may be told without any communication of going or burthen to the main spring. The pendulum may be applied many ways, or used in conjunction with the lever, to augment force or power, to quench fires, to drain land or ships, and to all sorts of grinding and craning. July 21, 10 Geo. 3; Aug. 2, 1770, 10 Geo. 3.

Daniel Bridges, of the town of Kingston-upon-Hull, doctor of physic: specification for "A new method of refining spermacœti, and making candles thereof infinitely superior to any candles hitherto made of spermacœti." August 10, 10 Geo. 3; Oct. 19, 1770, 10 Geo. 3.

Joseph Strutt, of Prescott-street, in the parish of St. Mary Matfelon, otherwise Whitechapel, (Middlesex,) glass seller: specification pursuant to patent granted to the said *Joseph Strutt* and *Jedidiah Strutt*, of the parish of St. Peter, in the town of Derby, (Derby,) hosier, for a machine, or engine, for roasting, broiling, or baking of meat, and other things usually roasted, broiled, or baked before the fire, consisting of a portable fire-grate or stove, an air or smoke jack, and a meat skreen or reflector, so contrived and adapted to each other, that they may with ease be removed from place to place, and may be used on board ship or in the field, or in public or private houses; in all which places the fire-grate or stove, air or smoke jack, meat skreen or reflector, may be separately applied. July 19, 10 Geo. 3; Nov. 8, 1770, 11 Geo. 3.

Mayer Oppenheim, of Birmingham, (Warwick,) merchant: specification for "A new method of manufacturing a beautiful opaque or transparent garnet, or red glass." Oct. 20, 10 Geo. 3; Dec. 17, 11 Geo. 3, 1770.

Richard March, of the parish of St. Clement Danes, (Middlesex,) hosier, and *William Horton*, of the parish of St. Matthew, Bethnal-green, (Middlesex,) frame smith: specification of a machine for making certain work, called "Knitted, Knotted, or Double Looped Work," for the making of stocking breeches pieces and gloves of silk, thread, cotton, or worsted, either together or separate. June 25, 11 Geo. 3; Oct. 24, 1771.

Sam Samuel, of Walworth, (Surry,) Spanish leather dresser and stainer of leather: specification for "A new method of dyeing and staining goat skins, kid, calf skins, sheep skins, lamb skins, and hides of all sorts, in the following colours (to wit), lobster red, rose red, scarlet, crimson, and morocco; in light green, gay green, laurel green, molequin green, deep green, Caladon green, parrot green, duckwing green, Saxon green, sea green, pea green, cabbage green, and grass green; in milk blue, pearl blue, pale blue, flat blue, middling blue, sky blue, king's blue, queen's blue, Turkish blue, and purple blue; in straw yellow, pale yellow, lemon yellow, and orange yellow: and in chocolate colour and coffee colour." Nov. 2, 12 Geo. 3; Feb. 21, 12 Geo. 3, 1772.

Samuel Unwin, of Sutton in Ashfield,

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(Notts,) bleacher: specification for "A machine for winding, doubling, and running of silk, thread, cotton, and worsted; and also linen, woollen, and all other kinds of yarns." March 23, 12 Geo. 3; April 24, 12 Geo 3, 1772.

Thomas Gale, of the parish of St. Mary-le Strand, (Middlesex,) cabinet-maker and upholder: specification for "A new invented bedstead" (press bedstead.) Feb. 1, 12 Geo. 3; May 20, 12 Geo. 3, 1772.

Samuel Chase, of Luton, (Bedford,) surgeon: specification for "A new invented medical cure for almost all scorbutic disorders, and their natural eruptive consequences, but more particularly for ulcerated and other sore legs, so frequently complained of in this kingdom, arising from the before-mentioned primary causes, which said medical process consists in giving, by regular turns, an electuary mixture and drops internally, and by the application of a digestive liniment and cerate externally." Feb. 12, 12 Geo. 3; June 6, 12 Geo. 3, 1772.

Charles Taylor, of Manchester. (Lancaster,) merchant: specification enrolled pursuant to patent granted to *Joseph Adkin the elder*, shuttle-maker; *Joseph Adkin the younger*, turner; the said *Charles Taylor*, and *Thomas Walker the younger*, merchant, all of Manchester aforesaid, for a machine for stamping and printing of paper, silk, woollen, cotton, and linen cloths, and other articles made of silk, wool, cotton, or linen, whereby the said stamping and printing will be greatly facilitated, and rendered much less expensive, and more perfect and exact. March 14, 12 Geo. 3; July 13, 12 Geo. 3, 1772.

James Rowley, of the parish of St. Martin, Ludgate, London, wine merchant: specification for "A method of making playing cards, printed from engravings on copper, after entire new designs in oil colours, with a peculiar kind of ink, which will bear the leesing, or polish, necessary to be given to playing cards, which no other ink known to the printers or cardmakers is capable of." April 7, 12 Geo. 3; August 6, 12 Geo. 3, 1772.

John Crumpler, of the city of London, gauze weaver: specification for "A new invented method of throwing silk, to make crape and tiffany to imitate and resemble what is imported from Italy under those names; and also a new engine, or machine, for dressing such silk, when so thrown and wove, to finish, complete, and make the same in every respect equal to the Italian." April 15, 12 Geo. 3; August 14, 12 Geo. 3, 1772.

Charles Rawlinson, of Lestwithiel, (Cornwall,) architect: specification of "A method for covering any kind or form of buildings with slate, in such a manner, and with such materials, as will want little or no repair, while the timbers remain good; which said covering cannot be rifled by wind, or hurt by frost, hail, or snow, or admit of any water, penetrating from the strongest driving rains, and will save a third part of the expenses of covering with rag-stones, or large slates," &c. May 22, 12 Geo. 3; Aug. 14, 12 Geo. 3, 1772.

Richard Williams, of the parish of St. Margaret, Westminster, (Middlesex,) gent.: specification for "A new method of manufacturing goods with cotton woofs, or woollen, linen, or cotton warps, and dressing such goods with a long shag on their surface." Oct. 15, 12 Geo. 3; Feb. 10, 13 Geo. 3, 1773.

Benjamin Collins, of the city of New Sarum, (Wilts:) specification for "A cephalic snuff, being a remedy for most disorders of the head, which it purges, strengthens the nerves, and revives the spirits." Jan. 18, 13 Geo. 3; May 4, 1773.

John Heys, of the township of Clayton, (Lancaster,) chapman: specification for "A method of making lees and ashes from marl, and other materials for bleaching of cloth and yarn, and for the use of soapers, dyers, and others." March 19, 13 Geo. 3; June 8, 13 Geo. 3, 1772.

Mathew Glenton, of Borough Bridge, (York,) innkeeper, and *William Clementshaw*, of Aldborough, (York,) whitesmith: specification for "An iron oven, upon an entire new construction, with a grate and regulator to add or diminish heat, to be placed in a particular manner on the backside of a common range fire, so as to bake every necessary article upon a more certain principle than any other oven yet known." April 23, 13 Geo. 3; June 26, 1773.

John Liardet, of Great Suffolk-street, in the parish of St. Martin's-in-the-Fields, in the city of Westminster, clerk: specification for "A composition, or cement, for all the branches concerning buildings to which the same is applicable, with a grease for frictions, preserving steel, iron, and various other uses." April 3, 13 Geo. 3; Aug. 3, 1773, 13 Geo. 3.

John Barbar, of Stainsby-house, (Derby,) esq.: specification for "A machine, with the apparatus thereunto belonging, which by fire, water, air, and steam, will purify fossil coal, extract metals from their ores, and collect their particles when volatilized by heat." April 21, 13 Geo. 3; Aug. 7, 1773, 13 Geo. 3.

Joachim Smith, of the parish of St. Paul, Covent-garden, (Middlesex,) gentleman: specification (in consequence of the many dreadful fires which have happened of late)

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for a machine, called a Retreat, or Escape, for the more expeditious, safe, and easy conveying persons and valuables out of a house when on fire, so simple that any person may make it ready for use in a minute, and grown persons and children, however helpless, may be conveyed out of a house without the least danger, and, should necessity require it, one person may go up the machine at the same time that another is coming down. May 15, 13 Geo. 3; Sept. 7, 1773, 13 Geo. 3.

John Fleming, now of the Minories, London, late of Grenada, in the West Indies: specification of a machine, or engine, for pressing sugar canes, and squeezing the juices therefrom, actuated by wheels, upon a peculiar and much more simple construction than any invention of the like nature [to be moved by wind.] Dec. 18, 14 Geo. 3; March 31, 14 Geo. 3, 1774.

John Wadham, of the parish of St. George in the East, (Middlesex:) specification for "A machine, called a Tea Fountain, constructed so as to answer the purposes of a tea-pot and boiler together, and will fill any number of cups, or other vessels, almost instantaneously, without the trouble of pouring out." July 27, 14 Geo. 3; Nov. 21, 1774, 15 Geo. 3.

Robert James, of Bruton-street, (Middlesex,) doctor in physic: specification for "A medicine called 'Doctor James's Analeptick Pills,' being a sovereign remedy for rheumatisms, whether seated externally or internally, for indigestions, crudities of the stomach from intemperance, loss of appetite, habitual costiveness, giddiness in the head, troublesome flatulencies in the stomach and bowels, and colics thence arising, as also for gouty habits where the stomach and head are affected, and for all kinds of bilious disorders, lowness of spirits, and nervous complaints, as well as in those disorders occasioned by a sedentary life." Nov. 25, 15 Geo. 3; Jan. 24, 1775, 15 Geo. 3.

Robert Barber and *Thomas Barber*, of the parish of Billborough, (Notts.,) gents.: specification of "A machine for heckling, turning, dressing, dividing, spinning, and twisting into threads, or wires, divers kinds of vegetable, animal, and fossil substances, which, by being connected with a weaving loom, and worked by men, horses, cattle, fire, air, or water, may, with uncommon expedition, be applied to working, warping, and weaving various patterns and shapes useful to society." Oct. 20, 14 Geo. 3; Feb. 15, 1775, 15 Geo. 3.

Francis Pinto, of Wells-street, in the parish of St. Mary-le-bone, (Middlesex,) gent.: specification for "A pump of a new construction, and upon new principles, to be worked by fire, by means whereof water may be raised to any height, and in any quantity occasion may require." Nov. 17, 15 Geo. 3; March 10, 15 Geo. 3, 1775.

Richard Champion, of Bristol, merchant, assignee of the remainder of a term of years under an Act of Parliament, intituled "An Act for enlarging the term of letters patent granted by his present majesty, to William Cookworthy, of Plymouth, chemist, for the sole use and exercise of a discovery of certain materials for making porcelain, in order to enable *Richard Champion*, of Bristol, merchant, (to whom the said letters patent have been assigned,) to carry the said discovery into execution for the benefit of the public." Sept. 12, 1775, 15 Geo. 3.

Walter Taylor, of the town of Southampton, blockmaker: specification for "A great improvement in the coghing or bushing cast-iron or metal shivers for ships' blocks and other things, whereby such shivers may be easily repaired when they are worn out at the centre, without new casting the same." Nov. 28, 16 Geo. 3; March 28, 16 Geo. 3, 1776.

Walter Taylor, of the town of Southampton, blockmaker: specification for "A great improvement in the construction of wheels for all manner of carriages, consisting of four parts: firstly, in the boxes; secondly, in the naves or stocks; thirdly, in the spokes; and, fourthly, in the securing the reems of the wheels," whereby a much greater abatement of friction is occasioned. Nov. 28, 6 Geo. 3; March 28, 16 Geo. 3, 1776.

Richard Arkwright, of Cromford, (Derby:) specification for "Certain instruments, or machines, which will be of public utility in preparing silk, cotton, flax, and wool for spinning, and constructed on easy and simple principles." Dec. 16, 16 Geo. 3; April 10, 16 Geo. 3, 1776.

Michael Searles, of the parish of Cripplegate, London, surveyor: specification for "A pinion and rack for the use of all kinds of pumps, water, and fire-engines, and other engines, where extraordinary power is required." Jan. 30, 16 Geo. 3; May 14, 16 Geo. 3, 1776.

Christopher Pinchbeck, of Cockspur-street, in the parish of St. Martin-in-the-Fields, (Middlesex,) toyman and mechanician: specification for "Certain simple additions to those very useful domestic machines called snuffers, by which the disagreeable circumstance of their dropping the wick, after snuffing the candles, is totally prevented." March 14, 16 Geo. 3; July 12, 1776, 16 Geo. 3.

Walter Taylor, of the town of South-

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ampton, blockmaker: specification for "Certain engines, tools, instruments, and other apparatus for making blocks, sheaves and pins, used in the rigging of ships," enrolled pursuant to the provisions of an Act of Parliament, passed 16 Geo. 3, for enlarging the term of letters patent, granted December 6, 3 Geo. 3, to Elizabeth Taylor, of the town of Southampton, widow. July 12, 1776.

William Horton, of the parish of St. Matthew, Bethnal Green, (Middlesex,) frame smith: specification for "A machine to be fixed to a stocking frame for making various sorts of knotted and double looped work." March 16, 16 Geo. 3; July 16, 1776, 16 Geo. 3.

Thomas Wood, of Holcombe, in the parish of Bury, in the county palatine of Lancaster, manufacturer of cotton: specification for "A machine or instrument for carding and roving silk, cotton, and sheep's wool, of a new construction." July 15, 16 Geo. 3; July 20, 16 Geo. 3, 1776.

Thomas Dewhurst, of Lower Darwen, in the parish of Blackburn, (Lancaster,) gent.: specification for "A new machine for spinning of cotton weft." July 16, 16 Geo. 3; Nov. 12, 1776.

James Guerimand, of the parish of St. Giles, (Middlesex,) watchmaker: specification for "A machine for measuring a ship's way more accurately than the log line, or any other mode heretofore invented, and called the Wheel Log, or Marine Perambulator." Sept. 9, 16 Geo. 3; Jan. 8, 1777, 17 Geo. 3.

Henry Hawkins, of Tooting, in the parish of Tooting, (Surrey,) engraver: specification for "A method of working an aquarello ground to be used on copper plates engraved for printing of linen, cottons, muslins, and calicoes, which aquarello ground produces various tints of a new construction." Nov. 19, 17 Geo. 3; March 7, 1777.

Stephen Hooper, of Margate, in the Isle of Thanet, (Kent,) merchant: specification for "An engine which will be of great use in lifting or raising water;" to be worked by wind. A parchment schedule of drawings of the invention is attached. March 14, 17 Geo. 3; June 21, 1777.

William Harrison, of Lamb's Conduit-street (Middlesex,) esq., and *Peter Atherton*, of the parish of St. Sepulchre, London, watch-tool maker: specification for "A new method or invention of making screws, and machines for dividing of mathematical instruments from the said screws." Feb. 5 last; March 7, 18 Geo. 3, 1778.

Richard March, of Temple-bar, in the parish of St. Clement Danes, (Middlesex,) hosier: specification for "A machine to be fixed to a stocking frame for making various sorts of single and double cross looped and inlaid work." A parchment schedule of drawings of the invention is attached. March 16, 18 Geo. 3; July 15, 1778, 18 Geo. 3.

William Harby, of Essex-street, in the Strand, (Middlesex,) hair dealer: specification for "A new kind of cemented hair shag;" the materials composing the cement are specified. July 13, 18 Geo. 3; Nov. 4, 1778, 19 Geo. 3.

William Bent, of St. Martin's-lane, in the liberty of Westminster, ironmonger: specification for "A new kind of ship blocks, which turn upon iron or steel pins or axles cased with metal." Dec. 23, 19 Geo. 3; April 23, 1779.

William Bent, of St. Martin's-lane, in the liberty of Westminster, ironmonger: specification for "A new kind of stove grates of which the front bars or parts through which the heat passes are cast in iron or other metal from the most elegant patterns." Dec. 23, 19 Geo. 3; April 23, 1779.

Robert Peele, of Church, near Blackburn, (Lancaster,) calico printer: specification for "An invention of a method for the dressing, carding, slobbing, roving, and spinning of cotton, silk, worsted and woollen." Feb. 18, 19 Geo. 3; March 13, 19 Geo. 3, 1779.

Matthew Wasbrough, of the city of Bristol, engineer: specification for "A new invented machine or piece of mechanism which, when applied to a steam engine, or any reciprocal movement, produces a circular or rotative motion without the medium of a water-wheel." March 10, 19 Geo. 3; July 6, 1779.

Richard March, of Temple-bar, in the parish of St. Clement Danes, (Middlesex,) hosier: specification for "A machine for regulating and spinning wool, silk, cotton, flax, hemp, &c." Nov. 15, 20 Geo. 3; March 11, 20 Geo. 3, 1780.

Joseph Flight, of the city of London, merchant: specification for "A method of making a colour for dyers and calico printers." (Black, purple, &c.) June 27, 20 Geo. 3; Oct. 26, 1780, 21 Geo. 3.

James Turner, of the city of Westminster, gent.: specification for "A method of producing a yellow colour for painting in oil or water, making white lead, and of separating the mineral alkali from common salt, all to be performed in one single process." Feb. 26, 21 Geo. 3; June 22, 1781, 21 Geo. 3.

William Parker, of Fleet-street, in the city of London, glassman: specification for "A method of making pedestals or sup-

porters for candlesticks, girandoles, chandeliers, candelabrums, lamps, candle-shades, epargns, clocks, watches, terms, tripods, vases, urns, busts, and figures of various materials and variously ornamented." March 28, 21 Geo. 3; July 23, 1781, 21 Geo. 3.

Henry Baker, of Liverpool, (Lancaster,) enameller: specification for "A new method of ornamenting glass by a composition of colours or materials imprinted or made upon the glass by means of copper or other plates, and wooden blocks or cuts." June 26, 21 Geo. 3; Oct 13, 1781.

Bryan Higgins, of the parish of St. Ann, (Middlesex,) doctor of physic: specification for "An art of extracting or producing mineral alkali and fixed vegetable alkali." July 31, 21 Geo. 3; Nov. 29, 1781.

John Arnold, of the Adelphi, (Middlesex,) watchmaker: specification for "A new escapement, and also a balance to compensate the effects arising from heat and cold in pocket chronometers or watches, and for incurvating the two ends of the helical spring to render the expansion and contraction of the spring perfectly concentric with the centre of the balance or verge." May 2, 22 Geo. 3; August 31, 22 Geo. 3, 1782.

James Crease, of Wellington, (Somerset,) painter: specification for "A pot, or pan, to be applied to a night-stool or necessary, or other purposes, which will prevent offensive smells." Aug. 1, 22 Geo. 3; Nov. 18, 23 Geo. 3, 1782.

Joseph Jacob, the younger, of St. Mary Axe, in the city of London, coachmaker: specification of "A method for the better constructing of carriage wheels and wheel carriages." Feb. 1, 23 Geo. 3; Feb. 11, 23 Geo. 3, 1783.

Peter Onions, of Myrther, (Glamorgan,) ironfounder: specification for "A new method of working and refining cast or pig iron, and converting the same from a fluid state into wrought or bar iron." May 7, 23 Geo. 3; Sept. 1, 23 Geo. 3, 1783.

John Heys, of Freckleton, (Lancaster,) soapmaker: specification for "A method of making ashes and lees from straw, turf, lime, dung, dirt of the street, soapers' waste lees, potato hulm, tanners' waste, bleachers' waste, and all sorts of weeds and vegetables, for the use of soapmakers, bleachers, and all others making use of ashes and lees." May 7, 23 Geo. 3; Sept. 4, 1783, 23 Geo. 3.

Thomas Bell, of Mosney, (Lancaster,) copper-plate printer: specification for "A new and peculiar art, or method, of printing with one colour, or with various colours at the same time, on linens, lawns, and cambricks, cottons, callicoes, and muslins, woollen cloth, silks, silk and stuffs, gauzes, and any other species or kind of linen cloth or manufactured goods whatever." July 17, 23 Geo. 3; Nov. 12, 24 Geo. 3, 1783.

Samuel Wingfield, of Brooks-market, in the parish of St. Andrew, Holborn, London, mason: specification for "A machine for cooking, wherewith a person may bake, boil, broil, stew, &c., at one and the same time, with one single fire." Oct. 2, 23 Geo. 3; Dec. 19, 24 Geo. 3, 1783.

Joshua Green, of Middleton, near Leeds, (York,) farmer: specification for "A new, expeditious, and advantageous method, by a particular kind of machinery, of drying and tentering all sorts of woven manufactured goods, such as broad cloths, narrow cloths, worsted goods of all denominations, likewise Norwich and Manchester crapes, cottons, velvets, stuffs, and all other woven manufactured goods whatsoever, whether made of wool, cotton, silk, flax, or hemp." Oct. 2, 23 Geo. 3; Jan. 23, 1784, 24 Geo. 3.

Christian Clauss, of Frith-street, in the parish of St. Ann, Soho, (Middlesex,) musical instrument maker: specification for "An improvement upon the musical instrument, commonly called the Guitar," whereby it is rendered the more capable of being played on in the manner of a piano-forte, and admits of a harp stop, and trumpet stop, &c. Oct. 2, 23 Geo. 3; Jan. 23, 1784.

Bryan Cornwell, of the parish of St. Dunstan, in the city of London, gentleman: specification for "a medicine, called the Oriental Vegetable Cordial." Dec. 1, 24 Geo. 3; March 27, 1784, 24 Geo. 3.

William Playfair, of Howland-street, in the parish of St. Pancras, (Middlesex,) engineer: specification for certain new mechanical methods of cutting or dividing pieces of metal, and of giving to pieces of metal a cylindrical, or other determinate, or uniform shape, continued through the whole length of the said pieces, and also of giving to pieces of metal shapes regularly tapering, by which bars, bolts, rods, wire, spade-bits, and shovel-bits may be made better, and more expeditiously than by the methods hitherto practiced; and also of giving to pieces of metals figured or ornamented surfaces, by which metal ornaments, beadings, and mouldings for doors, rooms, &c., and bordering for paper, &c., &c., may be made. [By rollers.] Dec. 17, 24 Geo. 3; April 17, 1784.

John Webb, of Vauxhall, (Surry,) yeoman: specification for "A new piece of machinery, for making a more easy and expeditious, and perfect division in stocking frame work manufactures than heretofore

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known." Feb. 5, 24 Geo. 3; June 5, 1784.

John Horn, of Dover: specification for "A new piece of machinery, for the purpose of sowing the seed of every species of vegetables in a manner entirely new, and more expeditious and regular than any heretofore known, and which requires a less quantity of seed to produce a large ...... than is expended by the common mode, and it also possesses the peculiar property of sowing in the broad-cast way, as well as dropping the seed into furrows, and may be regulated with ease, so as to sow any quanity, at the discretion of the seedsman." March 13, 24 Geo. 3; June 18, 1784.

John Slater, of Mosney, (Lancaster,) calico printer: specification for "A new machine for printing one, two, three, or more colours on cottons, calicoes, muslins, linens, silks, stuffs, dimities, jeans, velverets, woollen cloth, or any other species or kind of manufactured goods whatsoever." April 29 last; Aug. 21, 24 Geo. 3, 1784.

John Carne, of St. Austell, (Cornwall:) specification for "A new machine for raising and removing earth, sand, gravel, and other materials." July 3, 24 Geo. 3; Oct. 26, 1784.

Thomas Bell the elder, of Walton-in-the Dale, (Lancaster,) copper-plate printer: specification for "A new, peculiar, and improved art or method of printing one, two, three, four, five, or more colours all at one and the same time, upon linens, cottons, calicoes, muslins, woollen cloths, silks, stuffs, or any other species of goods, or articles capable of being printed by a much cheaper method than any hitherto found out." July 9 last; Aug. 2, 24 Geo. 3, 1784.

Richard March, of the parish of St. Clement Danes, (Middlesex,) hosier: specification for "A machine for the making and manufacturing of all sorts of plated work, plain and figured lace, chain lace, lines, ropes and cables, nets and net work [in metal.]" July 28, 24 Geo. 3; Nov. 27, 25 Geo. 3, 1784.

James Phillips, of George-yard, Lombard-street, London, stationer: specification for "A new construction of and improvement in and upon cocks and valves." May 20, 25 Geo. 3; June 18, 1785.

James Storey, of the Low Lights, in the parish of Tynemouth, (Northumberland,) esq.: specification for "A certain machine for drawing of coals, lead, tin, and other materials out of mines." Feb. 4, 26 Geo. 3; Feb. 22, 26 Geo. 3, 1786.

Joshua Walker, of Saffron-street, in the parish of St. Andrew, Holborn, (Middlesex,) brass founder: specification for "A new construction of and improvement in and upon cocks and valves." April 11, 26 Geo. 3; May 10, 1786.

Edward Strickland, of Birmingham, (Warwick,) mechanic: specification for "A new invented machine to prevent fire and housebreaking," [combining an alarum, pistol, &c.] July 3, 26 Geo. 3; July 29, 1786.

Joseph Ashton, of Bordesley, in the parish of Ashton, near Birmingham, (Warwick,) iron founder: specification for "An invention of casting and making buttons and button-shanks." Aug. 5, 26 Geo. 3; Aug. 30, 1786.

Thomas Lord Bishop of Durham, (formerly Thomas Thurlow, B.D.): surrender of the office or place of master or keeper of the house and church of our lord the king, of the New Temple, London, and the rectory of the said church, &c., held by patent May 22, 12 Geo. 3. March 14, 27 Geo. 3, 1787.

Valentine Gottlieb, of the parish of St. Botolph, Aldgate, perfumer: specification for "A considerable improvement in the construction of wheels and axletrees, which is calculated to decrease the friction, and consequently to diminish the labour in all sorts of carriages, and may be applied to machinery of other kinds, where wheels and axles are made use of." March 1, 27 Geo. 3; March 14, 1787.

John Kendrew, of Darlington, optic glass grinder, and *Thomas Porthouse*, of the same place, cloth maker: specification for "A mill or machine upon new principles, for spinning yarn from hemp, tow, flax, or wool." June 19, 27 Geo. 3; June 21, 1787.

William Johnson and *Mark Noble*, of Torrington-street, Ratcliff Highway, (Middlesex:) specification for "A new mode of overcoming resistance in mechanical operations by man or beast. April 15, 28 Geo. 3; May 14, 1788.

LIST OF ENGLISH PATENTS GRANTED FROM FEB. 8, TO FEB. 10, 1847.

George Grundy, of Manchester, manager, for certain improvements in furnaces, and in the flues and tiles used in the construction thereof. February 8; six months.

Christopher Vaux, of Frederick-street, London, gent., for improvements in storing and supplying beer, ale, and porter. February 8; six months.

Thomas Brown Jordan, of Belvidere-road, Surrey, for certain improvements in machinery for working mouldings. February 8; six months.

Thomas Du Boulay, of Sandgate, Kent, Esq.

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and John Du Boulay, of Bookshaw, in the county of Dorset, Esq., for improvements in fitting up granaries and warehouses, and of getting into condition and preserving therein grain, pulse, seeds, malt, and other perishable articles. February 8; six months.

William S. Kennedy, of Burslem, porcelain manufacturer, for improvements in attaching plain or ornamental surfaces of earthenware, china, or glass to articles made of metal, wood, or other materials. February 8; six months.

Stephen Moulton, of Norfolk-street, Strand, Middlesex, gent., for improvements in treating caoutchouc with other materials to produce elastic and impermeable compounds. (Being a communication.) February 8; six months.

John Zoach, of Birmingham, brass-founder, for a certain improved fastening, or certain improved fastenings for windows, shutters, doors, and tables; applicable also as a fastening or fastenings generally. February 8; six months.

Alexander Doull, of Euston-grove, Middlesex, civil engineer, for certain improvements in railway, steam-boat, and other signals. February 8; six months.

Stephen Geary, of No. 10, Hamilton-place, New-road, Middlesex, for certain improvements in obtaining and applying motive power. February 8; six months.

John Gedge, of 4, Wellington-street, Strand, Middlesex, for certain improvements in the machinery or apparatus used for watering grain. February 8; six months.

Enoch Wilkinson, of Oldham, in the county of Lancaster, overlooker, for certain improvements in looms for weaving. February 9; six months.

William Eaton, of Camberwell, Surrey, engineer, for improvements in machinery for twisting cotton or other fibrous substances. February 9; six months.

Uriah Clarke, of Leicester, in the county of Leicester, and Henry Barber, of the same place, fuller and dresser, for certain improvements in the manufacture of looped and woven fabrics. February 9; six months.

Charles Hancock, of Grosvenor-place, Middlesex, for improvements in the preparation of gutta percha, and in the application thereof, alone and in combination with other materials, to manufacturing purposes, which improvements are also applicable to other substances. February 10; six months.

Thomas Bramwell, of Newcastle-upon-Tyne, manufacturing chemist, for improvements in furnaces and apparatus to render atmospheric air available in producing cyanides and certain other compounds, which improvements in furnaces and apparatus may also be employed for other purposes. October 8, 1846; six months. The sealing of this patent was opposed by caveat; sealed 31st January, 1847.

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CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1228.] SATURDAY, FEBRUARY 20. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

THAMES PROTECTION FORT.—PROPOSED TO BE ERECTED ON THE NORE SAND BY WILLIAM BUSH, ESQ., C. E.

Fig. 1.

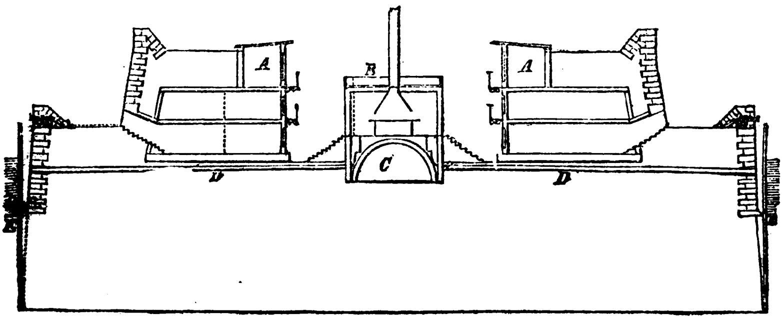
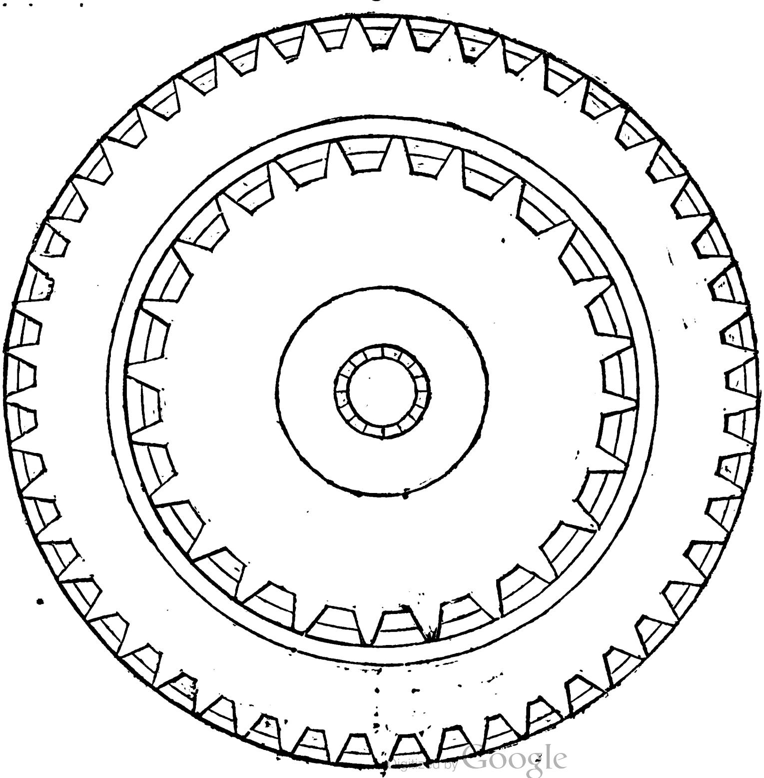


Fig. 2.



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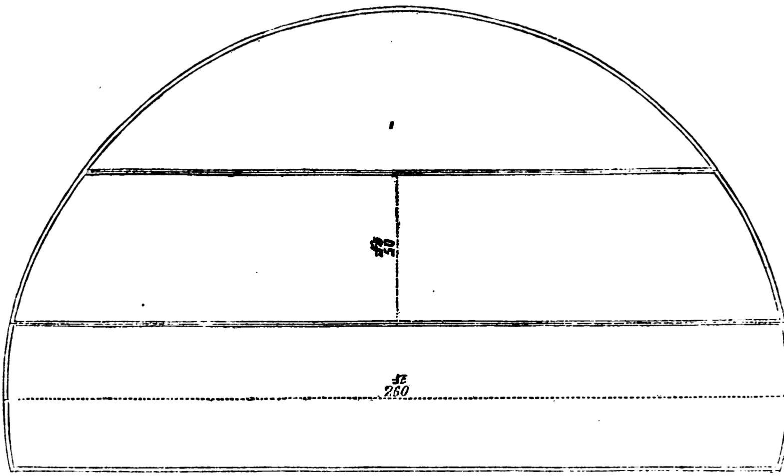
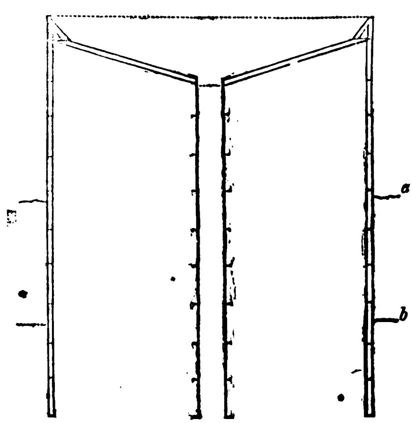
PLAN OF A FORT FOR THE PROTECTION OF THE THAMES AND MEDWAY, PROPOSED TO BE ERECTED ON THE NORE SAND, ON THE PATENT SYSTEM OF W. BUSH, ESQ., C.E.

Fig. 4.



It will, it is believed, be readily admitted by all who have paid any attention to the subject of our coast defences, that could a strong fort be erected on the Nore Sand, on or near to the spot where the present Nore Light is moored, it would serve far more effectually, than any fortifications which can be raised on the adjacent shores, to protect the mouths of the Thames and Medway from hostile intrusion. A battery of 100 large guns placed in such a situation—commanding, as it would do, the entire estuary, from side to side—would most assuredly hold the passage of the River against any force that could possibly be brought against it. The erection of such a structure on a shifting sand constantly covered with water, would not, doubtless, be an every-day matter; yet from what has been already accomplished in this way in the erection on the Goodwin Sands of the "Light of all Nations," we are justified in concluding that the thing is by no means impracticable. The structure just referred to exists, it is true, no longer; but its fall has been notoriously owing, not to any defect in the system adopted in its construction, but to its having been left (through an unhappy misunderstanding between the private adventurers, at whose cost it was constructed, and the public authorities) in an unfinished and neglected state, to the mercy of the winds and waves. As an exemplification of the practicability of sinking foundations under water for structures of any magnitude, by means of air-tight caissons,

Fig. 3.



on the plan patented by Mr. Bush, its success was complete. Whether it be a lighthouse or a fort that is to be con-

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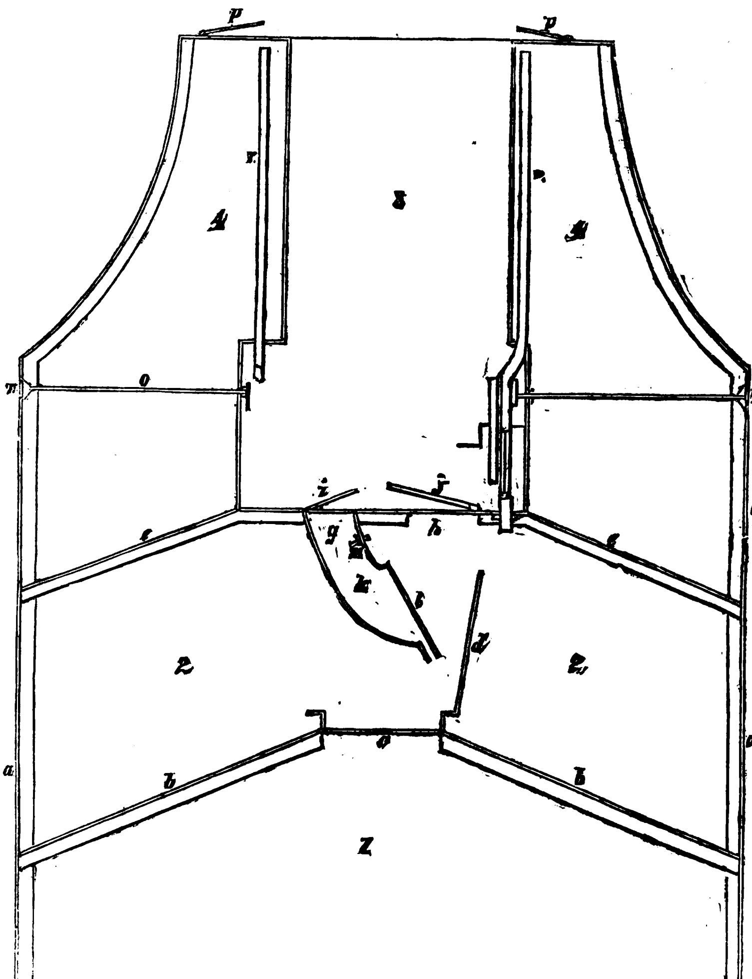
structed makes no difference as to the efficiency of the system; save only, that the less the elevation of the structure, the less the cost and difficulty of raising it.

In the accompanying sketches, fig. 1 represents an elevation of the fort proposed to be constructed by Mr. Bush on the Nore Sand; E E is the surface of sand; B, water-tank; C, coal-hole; D D, drain; A A, officers' room. Fig. 2 is a plan of the fort; fig. 3 is a section of one of the caissons; *a a*, high-water line; *b b*, surface of sand. Fig. 4 is a plan of the caisson.

H. B.

Mr. Bush's Mode of Sinking Foundations in Deep Water.



We extract the following details from the specification of Mr. Bush's patent, dated Sept. 21, 1841:

a a a is a caisson, which is composed of plates of cast-iron, bolted together, and made air and water tight in the usual manner. The

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bottom of the caisson is formed into a chamber (No. 1) by a partition, *b b*, (also of cast-iron,) having at top a manhole, *c*, which is closed by an air and water-tight valve, *d*; air is forced into the chamber No. 1 by pumps as usual. Over the chamber No. 1 there is a second chamber, No. 2, the floor of which is formed by the partition *b b*, and the roof of it by another partition, *e e*. In this chamber, No. 2, there are two manholes, *g* and *h*, which are closed by valves, *i* and *j*. There is also a third chamber, No. 3, for the purpose of inlet and outlet. K is a trunk, which fits in between this chamber No. 3 and No. 2, and has a door or valve, *l*, for the purpose of admitting workmen into and out of the chamber No. 2, with as little escape of compressed air as possible. The manner in which this trunk is applied is as follows:—Supposing a workman wishes to descend into the chamber No. 2, he is lowered first of all into the chamber No. 3. He then closes the door *l*, and opens the valve *i*, which allows him to enter the trunk; then, shutting the valve *i*, he opens the cock *m* in the trunk *k*, and admitting the air from the chamber into the trunk *k*, thereby equalizes the density of the air in the two chambers, because that in the chamber No. 2 is in a much more compressed state than that in the trunk K; then opening the door *l*, after having closed the cock *m*, he is admitted into the chamber No. 2, with only the loss of the air that is admitted into the trunk K to equalize the density of the two chambers.

There is a fourth chamber, No. 4, having two valves, *n n*, and opened by connecting rods, *o o*, passing through stuffing-boxes into the chamber No. 3, these valves *n n* requiring to be kept perfectly air and water-tight when they are fixed in their seats. There are also two manholes, *p p*, at top of this chamber No. 4, for access thereto. *r r* are two pipes, which pass from the top of the chamber No. 4 into that of No. 3, the ends of the chamber No. 4 being open, while those in the chamber No. 3 are connected to air-pumps and worked in the usual manner. These pipes are fitted with stop-cocks, in order to regulate the supply of into the chamber No. 2.

The action of the apparatus is as follows: The apparatus, after being floated over the site of the intended operation, the chambers 2, 3, and 4 are filled with air, and the machine lowered into its place. The valves *m n* are then opened, and the water flowing into the chamber No. 4, forces the air into the chamber No. 2, by means of the pipes *r r*; the density of the air in the chamber No. 2 increasing in proportion as the water rises in the chamber No. 4. The valves *n n* are then shut, and the workmen descend into the chamber No. 3, and are admitted into the chamber No. 2 by means of the trunk K, as above described. The valve *c* is then opened, and the pumps set to work, which force out what water there may be in the chamber No. 1. When this is completed, the workmen descend into the chamber No. 1, and commence their excavations, throwing the earth, sand, &c., through the manhole *c* into the chamber No. 2, the caisson sinking in proportion as the earth is removed. The workmen, having finished their excavations, ascend into the chamber No. 2, and having closed the valve *d*, they open the valve *j*, and the earth is drawn up by suitable tackle and buckets through the manhole *g*. They then close the valve *j*, and again descend into the chamber through the manhole *c*, after having opened the valve *d*, and again commence their operations, so continuing till the caisson is sunk to the depth required. The partitions *b b* may then be taken out, and a foundation of concrete laid and the building commenced. Where it is necessary, the whole of the interior fittings may be taken away, leaving nothing but the caisson, which forms a good exterior to the building.

It will be observed that none of the chambers are open directly to the atmosphere excepting the chamber No. 3.

We add to our sketches a view of the "Light for all Nations" as it was in its complete state, when Mr. Bush and his family "slept in it for an entire fort-

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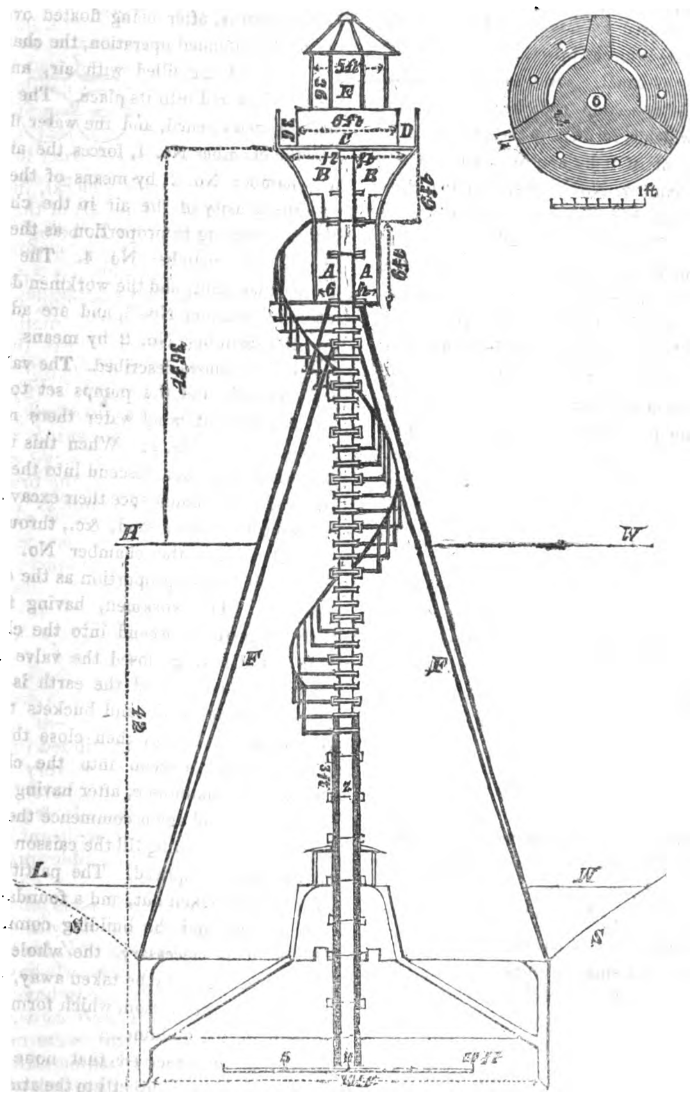
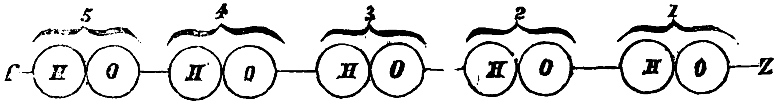
night, exposed to many heavy gales." A is a room containing cooking apparatus; B, dining-room, capable of containing twelve persons; C, sleeping-room; D, gallery; E, lantern; F, 12 iron stays, 1¾ in.; H H, high-water line; L M, low-water line; S, surface of sand.

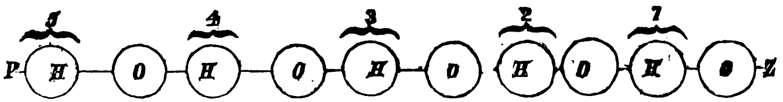


SUGGESTIONS TOWARDS A DYNAMICAL THEORY OF GALVANIC ACTION.—(CONCLUDED FROM P. 151.)

3. There can be little doubt that the particles of oxygen and hydrogen are much more closely connected than the particles of water which they form. In taking any line of fluid particles the arrangement may be represented thus :



There is no ground for supposing that (H) and (O) are in actual contact, any more than the water particles ; but this will make no difference in the reasoning : neither will the order of position of (H) and (O), as regards Z and P, though, in the diagram, O is placed nearer to Z than H is, to facilitate the view here taken of the action. The actual motion of each particle could be actually determined, if the attractive force of Z were known both as to its law and intensity, and also that of O and H, for each other, together with the respective distances. As we really know none of these absolutely, but only the relation which some of these bear to the others, we must be content with general, instead of accurate results. The (O) of the particle of water nearest to Z, being more attracted by it than (H) is, will move off faster than (H) can follow it : the attraction of (H) for (O) lessening as the distance increases. But the motion of the 1st group necessarily causes that of the 2nd, in consequence of the attraction of the (H) in (1) for the (O) in (2), and this attraction goes on *increasing*, because the distance is *lessening*. The arrangement might at any stage of the process be thus represented, the brackets (1), (2), &c., being the same as in the last diagram.



The particle (H) of No. 5, is thus liberated from all combination, unless other substances be present ready to combine with it. If only pure water is present, a certain quantity of (H) is set free at the plate P. This diagram and illustration is scarcely different from the one so common in treatises on the subject : but it is not shown in these books that such an action is simply a dynamical one, and a necessary consequence of the attraction of Z for O and of O for H.

4. There will thus be a new series of groups formed : each of which will oscillate backwards and forwards, until it comes to rest. That is, provided the attractive force of Z, which is destroyed by its combination with (O), is not renewed by the removal of the oxide formed. But suppose the oxide is removed, there being still no connection between the plates P and Z, except the surrounding atmosphere, a continued action would then ensue, but of so very feeble a nature as to be scarcely perceptible. (This, of course, we conclude from experience—for otherwise we could not foresee anything of the possible intensity of the action.)

5. All this, however, as is obvious, depends on there being *no attractive* forces acting, except those of Z for O and H for O. In other words, we have all along supposed the plate P to have been completely neutral, *as well as* without connection with Z. If this were not the case—if, for instance, P had an attraction for either (H) or (O), either no motion whatever, or a motion determined by the relative forces of P and Z for the other two elements would take place. It would be worth while to try, by a course of chemical experiments, what would be the effect of placing two different materials

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in any solution—without contact, *i. e.*, to determine whether any voltaic effect could be elicited.

6. We must now consider the effect of opening a metallic communication between P and Z; still supposing P to exert no attractive force. The first series of motions being the same as before, and the oxide of zinc removed as fast as it is formed, let us consider the motion at any particular instant. We have a series of particles in a state of vibration—the extreme particle at the zinc end constantly eliminated at the end of each oscillation, as a compound with zinc,—the extreme one at the platinum end as hydrogen gas; the series of decompositions and recompositions going on as described.

Now, at each impact, for instance, against P, this impulse is not destroyed: it is communicated to every particle of metal in the plate, and by them must be again communicated to other objects. The connecting wire, being joined with the two plates, will itself become subject to the same vibration, and of course communicate it to the zinc.

7. To illustrate how this vibration of the zinc may increase the energy of the action: Suppose we take a magnet and an iron ball. Suspend the ball by a string from any fixed support, and bring the magnet near. The ball will approach and cling to the magnet. Suppose this very contact to destroy for the moment the power of the magnet, (as, for example, in the magneto-electric pendulum, and various forms of contact-breakers,) the ball will commence a return oscillation. When, at a certain distance, let the magnet be suddenly *brought nearer*, and then drawn back: of course the rapidity with which the ball will *now* approach will be greater than it was before. Again, let the contact destroy the magnetic power, and the ball return; and again, let the magnet be suddenly approached and drawn back as before, the same accelerated motion will ensue, and so, by this sudden approximation and withdrawal of the magnet, will the rapidity of the action be greatly increased. The zinc is our magnet attracting the particle or ball (O). The very contact of the two, by forming an oxide, destroys *for the moment* the attractive power. The return-oscillation of the particle commences, but the vibration of the zinc plates is precisely that sudden following or approximation of the magnet we have supposed, and the resulting effects similar. That which causes the *return* movement of the particles of water, is probably the conjoint effect of the pressure of the surrounding fluid, but chiefly of the attraction of the oxygen and hydrogen for each other. Of course the vibrations might not in every case be *synchronous* throughout the whole system: *i. e.*, the vibration of the zink, for instance, might be such as to *oppose*, instead of to *augment*, the motion of the particles of water: as we might in our illustrative example easily move the magnet backwards and forwards so *irregularly* as to destroy the motion of the ball instead of increasing it. But, although it is perhaps not possible to *prove* this isochronism, there is the highest degree of probability that the *aggregate* of all the separate vibrations is of this nature: and such as to keep up the rapidity at a fixed rate, until the diminishing energy of the chemical forces gradually reduces it. But at the beginning it is a gradually increasing—then a uniform—and lastly, a diminishing action, or motion.

8. If the terminal wires be immersed in any solution, the vibrations of the particles of the positive wire are communicated to those of the solution, and the decompositions and recompositions which take place are of a similar nature to those in the battery itself. In speaking of the *battery*, I include any number of cells; for the preceding views are of course applicable to any number of pairs of plates, the platinum of one cell transmitting its motion to the zink of the other, and thus through the series. The difference between the effects of varying the *number* of plates as compared with those from varying their size, must on this view be sought in the mode of communication between the platinum of one cell and the zink of another. But the ultimate explanation will necessarily be this: from one we obtain, in a given time, a greater velocity in a smaller mass; and from the other, a smaller velocity in a greater mass. The momentum, when the whole system is taken into account, viz., plates, wires, fluid, &c., must be the same for an equal amount of chemical action. Thus, whether we make 100 square feet of zink and 100 ditto of platinum into one cell, or into 100 cells, provided the acid used be the same, the

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electrical effects + the chemical effect + the heating effect + the luminous effect, &c., must be the same: one may vary, but the whole sum is constant. But, as Professor Grove has said, that which is now chiefly wanting, is a mathematical or numerical relation between these different (to our senses) though simultaneous effects. For instance, given the ratio between two chemical forces, to find the ratios between the heating effect of one and those of the other—of the luminous effect of one and the luminous effect of the other—and so on. These ratios will necessarily be found to be *functions* of certain quantities which themselves depend on the *mode* in which the chemical forces (for instance) are applied; as in the present case, where the ratio depends on this and that form of battery, the number and size of the plates, thickness of connecting wires, and so on. Regarding, as I do, the whole series of heating, luminous, &c., effects as merely one uniform system dependent on the same simple cause, and that cause motion, the next remarks will be founded on this supposition.

9. When a wire used to conduct the electricity is of a certain thickness, there is said to be a "resistance" to the current, and the same term is often used in reference to the effects on a thinner wire when it becomes heated by this passage of the current. It is evidently inconsistent to apply the same term and attach the same notion to the two different effects. According to the view here taken, the effect of the battery is to put in motion a certain mass of matter with a certain velocity. If the mass of matter be lessened the velocity will be increased, and *vice versâ.* For example, let the "power" of a certain battery be sufficient to put in motion every portion of a wire weighing ten pounds with an average velocity of vibration (in each particle) of 1,000 feet per second. Then, if we take a wire weighing five pounds, the velocity of vibration of its particles will be twice the former, or 2,000 feet per second; or if the weight be twenty pounds, the velocity would be half, or 500 feet per second, and so on. Now the degree of velocity of each particle measures the heat, (not necessarily the *sensible* heat alone, but the whole heat in whatever form it becomes manifest or remains hid.) The particles of a thinner wire, then, moving with greater velocity, give out, generally speaking, the greater sensible heat. If the velocity become sufficiently great, each particle gets so far away from its neighbouring particle, as to destroy all cohesion—in other words, fusion takes place.

10. The communication of the motion of the particles of metal, or other substances, to the particles of the elastic medium termed "ether," will, of course, be acknowledged as the source of light by all who accept the undulatory theory. That this theory is not universally adopted is owing in great measure to the unfortunate circumstance, that the nature of the evidence for it is only to be *fully appreciated* by mathematicians of considerable attainments. By these, with two or three solitary exceptions, the theory is looked upon as entitled to equal confidence (in its general features) with that of universal gravitation—and for precisely the same reasons; viz., that it has not only explained and calculated nearly all the known facts in optics, but actually predicted some of the most extraordinary facts. If one mathematician —Adams, for instance, has any reason for confidence in a theory which has enabled him to point out the existence and actual position of a yet unseen and unheard-of planet: with equal right, I say, does another mathematician—Sir W. Hamilton, pronounce on the truth of a theory, which has enabled him to foretell what would be the result of a most extraordinary and unthought-of experiment in optics, viz., that of "conical refraction"—or Fresnel, long ago, when his theory predicted a species of double refraction which had never before been dreamt of. The proofs in both cases are equally overwhelming. These things are alluded to here for this reason: he who is once firmly convinced that the whole phenomena of light depend on a vibratary motion, (no matter whether every minute particular can be assigned or not,) will in the present state of science feel very strongly inclined to consider electricity, heat, &c., as the results of similar motion; and though he will not take up any *particular* view of this motion, until the same has been for electricity, heat, &c., as for light, viz., the known facts *calculated,* and new ones predicted; yet he will consider this *kind of motion* as that to which we must look for further

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explanations. A great many of the phenomena of heat have been found by Professor Forbes, of Edinburgh, to be precisely analogous to those calculated in the undulatory theory of light for optical phenomena. Now, until it can be shown that there is some inherent improbability in the supposition that these kindred classes of facts are all modifications of vibratory motion—is it not more reasonable to *try* whether we cannot extract some good—some hints towards experiments—some general views to guide us in the pursuit of the investigation; than to turn away with blind obstinacy from a theory, because as yet it is a theory only? It is very true, that as yet so little, even of a purely theoretical nature has been brought forward clearly, that it is impossible to derive any "hints" even of a practical utility. As a very imperfect attempt towards this end, I shall conclude these remarks with a few such practical suggestions; and if it should be found possible to deduce any further results from a general consideration of the nature of the motion, they may be added in a future communication.

11. Since, if two unequal impulses be transmitted along the same line of particles, in different directions, the resulting motion must be modified, the following question is suggested:—

(1.) What will be the effect of immersing in the same chemical solution the terminal wires of two batteries, so that the positive wire of one battery is close to the negative wire of the other; the effect on the liberated gases to be measured by the volta-meter, and compared with those of either battery acting separately?

A similar experiment might be tried on the "heating effect," thus,

(2.) Connect the positive wire of one battery and the negative of another into another common wire; and so with the negative of the first and positive of the second into another common terminal wire; then complete both circuits by joining these two wires, and measure the heating effects as compared with those of each battery separately. It is greatly to be wished that experiments similar to those on "interferences" in optics could be made on this subject—that is, procuring two "currents" starting from the same point, and, with equal intensity, make them arrive at another point by routes differing from one another in length by the smallest possible quantity, and examine the resulting effects,—whether chemical, magnetic, &c., &c.

(3.) Is there any difference between the state of that surface of the zink plate opposed to the negative element and that turned away from it? I do not remember to have seen it noticed anywhere that the chemical action on the two sides of the zink plate is different in amount—viz., a greater quantity oxidized on one side than the other—which yet I think very likely to be the case.

(4.) Are chemical effects ever observed in a solution *after* the wires have been removed for an instant? For example, when a powerful battery has been used to decompose water, on taking out one or both wires, is any gas evolved during any appreciable time *after*? I should be inclined to look for such results in some degree, however slight, from the *momentum* generated.

To those who have acquired a clear notion of the general nature of vibrator motion between a series of particles, such as here considered, a great number of similar questions will readily occur, affording some guide towards experimental research—by the results of which, of course, all theories must stand or fall.

A. H.

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

No. 3.* CUBIC EQUATIONS—THE METHODS OF CARDAN—IVORY—GRAVES, ETC.

On substituting $y+z$ for x in a ("simple") cubic equation deprived of its second term, the result is a cubic equation between two unknown quantities—that is to say, a binary cubic.† The solution of the original equation is now reduced to that of a problem which is perfectly indeterminate, and which, since it contains two disposable quantities, may be broken up into two distinct equations. Among the variety‡ of ways in which this may be done, there is one only which will avail us for the solution of the given equation§—it is as follows:

Let S_3 denote the sum of the cubes of y and z; P the product of those quan-

* No. 2 will be found *ante*, p. 122.
† See *Mech. Mag.*, vol. xlv., p. 582.
‡ Barlow's *Tables*, (1814,) Introduction, p. xxv.
§ Ibid, p. xxv.

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tities; a and b two known quantities: then the binary cubic is of the form

$$S_3 + a + w\,(P + b) = 0,$$

and this being broken up into the two equations $S_3 + a = 0$, and $P + b = 0$, y and z, and consequently x, may be determined.*

This is the purely *indeterminate* method of solving a cubic deprived of its second term, and is known by the name of CARDAN'S. The above may be said to be its type of solution. As it is sometimes given this method is encumbered with superfluous values, and the roots obtained are, in fact, those of an equation of the ninth degree.† The other method of solving a cubic, which has been discussed in these notes, is free from the superfluous values just alluded to, and is in that respect, and, perhaps, in point of simplicity, more convenient than the method of CARDAN.‡ But even when so obtained the roots are in reality the roots of the equation of the sixth degree, which is formed by squaring the original cubic, as is observed by LAGRANGE, at page 138 of the *Nouveaux Mémoires de l'Académie Royale* (of Berlin) for 1770.

We have seen (*ante*, p. 124, note†,) that the roots of the auxiliary or *réduite* equation in this latter method, when considered as functions of the roots of the given cubic, are the same as those which occur in the reducing equation proper to the method of CARDAN. But there is no absolute necessity for having recourse to the theory of LAGRANGE and VANDERMONDE for the purpose of showing the ultimate coincidence of the two methods. Not only are the reducing equations in both cases identical, but both solutions are in fact subjected to the same type of solution.

For, in the method of CARDAN, of the two quantities (y and z) substituted for x, one of them (z for instance) being determined by means of the reducing equation, the other (y) is determined by means of an equation of the form

$$y^3 = A;$$

which, since $y = x - z$, may be represented by

$$F'''(x-z) = F'''(a);$$

for A is a known quantity. So that, not only when viewed by means of profound theories, but also when regarded in the far less general point of view dwelt on in these Notes, the two methods are *ultimately* identical. Nor is this the only instance in which such uniformity of process occurs in the theory of equations.

I shall next proceed to mention a method of resolving cubic equations given by IVORY at pp. 99–116 of vol. v. of the *Transactions of the Royal Society of Edinburgh* (1805)—a method which at a first glance would seem to be excluded from the scope of these Notes by the fact of goniometric functions being introduced into the question in the second paragragh of the paper which contains it.

In the first paragraph IVORY divides "cubic equations into two varieties or species; the one comprehending all cubic equations with three real roots; the other all those with only one real root."‖ And it was, doubtless, the arithmetical application of his methods to cubics of the former class, that caused the illustrious writer to introduce the circular functions into his paper at once. In these arithmetical applications it is needless to say that he is perfectly successful. But he makes no attempt to show the connection between methods applicable to the two different cases—a deficiency which, as both may be considered in a purely algebraical point of view, I shall endeavour, with great diffidence, to supply.

It is in the consideration of questions of this sort that we feel with peculiar force the (I was about to say) *necessity* of taking those strict and rigid views of algebra, in the enforcement of which our countryman, Dr. Peacock, has taken so important and brilliant a part. We need not here dwell further on those views, than to show that, from the method employed by IVORY to solve a cubic with one real root, we may evolve a SYMBOLICAL solution which shall include the irreducible case—that is, the case in which all the roots are real.

Now, IVORY reduces any given cubic to one of the two following forms (*Edin. Trans*. vol. v., pp. 99, 100,)

$$z^3 - 3\tau z^2 - 3z + \tau = 0,$$
$$z^3 - 3\tau z^2 + 3z - \tau = 0;$$

* Peacock, *Third Report of British Association*, pp. 307, 308. Young, *Theory of Equations*, (1843,) p. 441. *Mech. Mag*., vol. xlii., p. 19.

† Peacock, *Third Report of British Association*, p. 308. Lagrange *Nouveaux Mém. de l'Acad.* de Berlin,) for 1770, pp. 139, 140, art. 4.

‡ *Mathematician*, vol. i., p. 113.

‖ *Edin. Trans*., vol. v., p. 69, paragraph 1.

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to the first form, when the roots are all real, and to the last when one of them is real and the others imaginary. In the latter case we see that

$$\tau = \frac{3z + z^3}{1 + 3z^2}$$

and from this equation is deduced the solution of cubics having only one real root. But when the given cubic is reduced to the first of the above forms, we may change the sign of the result, and write it

$$-z^3 + 3\tau z^2 + 3z - \tau = 0.$$

Multiply this by $\sqrt{-1}$, make $z\sqrt{-1} = z'$ and $\tau\sqrt{-1} = \tau'$, and it becomes

$$z'^3 - 3\tau' z'^2 + 3z' - \tau' = 0,$$

an equation of the second form, whence a purely algebraic solution may be obtained by means of unreal expressions, and both varieties or species of cubic equations will be included in one method of solution.

The type of solution of IVORY's method presents a resemblance to the former types sufficient to show an ultimate uniformity of process in all these methods. On referring to page 100, of the volume of the *Edinburgh Transactions* before cited, we see that the following equation obtains,—

$$(1-\tau)F'''(1+z) = (1+\tau)F'''(1-z),$$

nearly the same type as in the former methods.

The present appears to be the proper place to mention a method of solving cubic equations proposed by Mr. Graves at p. 217, of vol. xiii., of s. iii., of the *Philosophical Magazine.* This method includes the most general algebraic form of cubics—that in which the coefficients involve unreal quantities. Mr. Graves has not there explained his process, but, as it seems essentially to involve goniometric functions and processes, it will have no place among the algebraic methods.

There is yet another solution of a cubic which I shall perhaps be excused for mentioning here. I allude to my solution published at p. 248, of vol. ii. of the *Cambridge Mathematical Journal*, and subsequently further discussed by me at pp. 28 and 104 of vol. iii. of that work, and at p. 195 *et seq.* of vol. i. of the *Mathematician.** In this case it will be seen that the type of solution is

$$F'''(Ay + B) = F'''(Dy),$$

or, dividing both sides by y, making $\frac{1}{y} = v$, and slightly changing the form the result,

$$F'''(v + A') = F'''(B'),$$

which resembles that of the other solutions.

Those methods which proceed by assuming a certain form for, or certain properties of, the roots, will with greater propriety be discussed separately—more especially as those methods are, in their nature, general.

The distinction between the *subsidiary* and the *indeterminate* methods, I have already adverted to. The indeterminate methods themselves admit of distinction. To the first class, or the *pure indeterminate* method, belongs the method known as CARDAN's. But there are other processes which, indeterminate to a certain extent, inasmuch as they introduce two or more undetermined quantities in lieu of x into the given equation, are yet so far determinate, that the undetermined quantities are introduced for the express purpose of satisfying conditions the number of which does not exceed that of the disposable quantities. For instance, in the solution of IVORY, for x is substituted an expression containing three disposable quantities, two of which are employed in reducing the given cubic to another in z, which is of a solvible form, by satisfying two separate conditions. So that if we bear in mind, from the first, the whole requisites of the question, the problem will not be indeterminate, except in form. So, in my solution of a cubic, last alluded to, although we substitute for x the sum of two undetermined quantities, (y and z,) yet the latter, as we know beforehand, is to satisfy one determinate equation, which will reduce the given cubic to a solvible cubic in y.

To distinguish this method from the purely indeterminate one, it may be termed the PSEUDO-INDETERMINATE method. A further exemplification of it will be found in the process of TSCHIRNAUS for taking away two terms of an equation.

I take an opportunity of remedying an

* A more general form, to which the same process of solution as that involved in this case is applicable, will be found at p. 116 of vol. i. of the *Mathematician.* In a preceding page (118) of the same volume will be found a few remarks on my solution of a cubic equation, mentioned in Note 1, *ante*, p. 105.

oversight in my last Note. In endeavouring to effect the reduction of a biquadratic to the binomial form, by the means proposed at page 125 of this volume, I omitted to impose the condition that we are to make use of no other property of the unreal fourth roots of unity than that given by the equation

$$1+a+a^2+a^3=0,$$

where $a=\sqrt{-1}$. The alleged impossibility of the reduction is to be limited to the case in which we are confined to this property.

I am, Sir, yours, &c.,
JAMES COCKLE.

2, Church-yard-court, Temple,
February 15, 1847.

NOTE ON A PRECEDING PAPER, (PAGE 82.) BY PROFESSOR YOUNG.

Sir,—The last *part* of the *Mechanics' Magazine* has but just arrived here. Upon looking over the short paper which you have done me the favour to insert at page 82, I see that there are one or two typographical errors, which you will perhaps allow me to correct. In the expression for the sum of the squares, (p. 83), $n-2$ should be $n+2$, and $+1$ should have been introduced in connection with the fraction within the brackets. Also in the expression for the sum of the fourth powers, the fraction $\frac{(n-1)\,n\,(n+1)}{3}$ should have appeared immediately before the last fraction.

In stating the general principle, I have observed (p. 83) that "we have only to write down as many binomial factors, having 1 for their common difference, as there are units in the exponent of the power before us, and then to introduce the correction necessary to reduce their product to equality with the general term." Remembering that I was writing for learners, I think I should have noticed that, in determining this correction, it is not necessary to compute the aforesaid product by actual multiplication: the fundamental principle in the construction of equations, and, indeed, the obvious law of the coefficients in the composition of a product of factors, such as $(x+a)$ $(x+b)$ $(x+c)$, &c., enables us at once to write this correction without algebraical multiplication at all. Thus, in the case of the fifth power, for instance, that part of the correction involving the fourth power is obtained by taking the sum of the numbers which occur in the binomial factors already written, and writing this sum, with changed sign, as coefficient of the fourth power. The part of the correction involving the third power is found by taking the sums of the products of the same numbers, two and two, and writing the result, with changed sign, as coefficient of the third power. In like manner, taking the products three and three, the result, with changed sign, will be the coefficient of the second power; and the product of all four of the numbers will be the coefficient of the first power, the sign being changed as before.

In this way the correction for n^4, after having written down the factors $(n-1)$ n $(n+1)$ $(n+2)$, is obtained, term after term: the sum of the numbers $-1+1+2$ gives 2; so that -2 is the coefficient of n^3. The sum of their products, two and two, is $-1-2+2$, so that 1 is the coefficient of n^2; and the product of all the numbers being -2, the coefficient of n is 2. In like manner for n^5, the numbers in the factors $(n-2)$ $(n-1)$ n $(n+1)$ $(n+2)$ giving zero for their sum, show that n^4 does not enter the correction; the sum of their products two and two being -5, we infer that $5\,n^3$ is a part of the correction; the sum of the products three and three being zero, n^2 disappears; and lastly, the product of all the numbers being 4, the remaining part of the correction is $-4\,n$. These details, though quite superfluous to the experienced algebraist, may not be useless to those for whom this short method of summing the powers of the natural numbers is intended.

J. R. YOUNG.

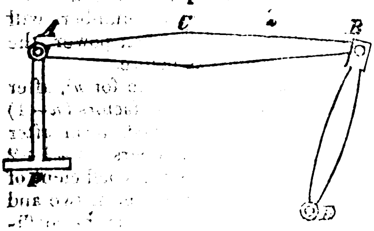
Belfast, Feb. 8, 1847.

ON CERTAIN POINTS OF ADJUSTMENT OVERLOOKED IN THE CONSTRUCTION OF RECIPROCATING ENGINES.

Sir,—Although of late years both the design and workmanship of machines have been carried to the highest pitch of excellence, it appears to me that the attention of engineers has not been sufficiently directed to that point in their construction which I shall now bring under your notice.

In considering those parts of a machine which have a reciprocating action, we must observe, that any small resistance offered to motion, and dependent on the

frequency with which the direction of motion is changed, will have an effect constantly accumulative in diminishing the duty of the engine. Now, any part of a system, rigidly connected, would, if vibrating free about its particular axis, oscillate with a determinate periodic time, that, in fact, of its isochronous pendulum. If compelled, therefore, to move with any different periodic time, there must be a continual opposition to motion proportional to the error in time and the momentum of that part.



Take, for instance, the two principal vibrating parts of a steam-engine (of the common construction.) The periodic time of vibration of the beam A B, about the axis at C, (with the additional weights at A and B considered,) will be fixed; but if the stroke of the piston be more or less frequent than this time, the immense mass will be alternately accelerated or retarded in its progress, and reduced to rest at instants not coincident with the natural recurrence of these states.

Again, the motion of the connecting rod B D, (regarding only its horizontal deflection at the crank end D,) will have a determinate period not necessarily the same as that of the stroke of the piston, and hence subject its motion to similar resistance during each instant.

Nor can we oppose to these suppositions the fact, that in no instance could the motion of all parts of a rigid system be made coincident with the *natural* vibrations of the several parts; for, although at no moment is the velocity of any point in A B the same as that dependent on a simple deflection through the same arc, and consequent oscillation of A B supposed free, yet we may separate both the spaces, periodic times, and velocities, into their particular parts, resulting from the different forces which produce them, and which, by superposition, give the actual motion of the beam A B. From these considerations it would appear that when the periodic time and velocity of the point A are given, (which will be obtained respectively from the number of strokes of the piston in a minute and the length of stroke,) the masses and dimensions of each separate part of the rest of the engine should be so adjusted as to make their vibrations coincident with those actually transmitted to them. The importance of such an adjustment would, of course, increase with the dimensions of the moving parts; but I am sure that, especially in marine engines, the effect of a proper attention to this matter would appear manifest by the decrease of the strain at all the centres of motion, gudgeons, &c.

I am, Sir, yours, &c.,

JOHN M'GREGOR.

Feb. 1847.

RECENT AMERICAN PATENTS.

[Selected and abridged from the *Franklin Journal*.]

AN IMPROVEMENT IN THE APPARATUS FOR TANNING LEATHER. *Francis D. Parmelee.*—The vats in which the hides are suspended are so constructed and arranged as to permit the liquor, which has acted on the hides, to run off, and above these vats there is a traversing carriage which delivers the ooze on to the hides.

Claim.—"What I claim as my invention is the combination of a traversing carriage for distributing the ooze on the hides, substantially as above described, with a vat or vats, in which said hides are suspended, and from which the spent liquor can drain."

AN IMPROVEMENT IN THE INK-HOLDER OR INKSTAND. *Daniel Harrington.*

Claim.—"What I claim therein as new is making the rotary top of the ink-holder, with pen holes, and a cup-formed recess in the middle, fitting in a large central opening in the permanent top, which is also provided with pen holes, in like manner as the rotating top; when the two are combined by means of the spring handle, which secures the two together, and affords an easy and ready mode of removing the top to supply ink, whilst it answers the purpose of a ball handle, to carry the ink-holder."

IMPROVEMENTS IN MACHINERY FOR MAKING LEAD PIPES. *Nathan Buttrick, Jr.*

Claim.—"Having thus described my invention, I shall claim the above described peculiar manner in which I arrange the cylinder with respect to one or two melting cisterns, and the furnace whereby the said cylinder is heated wholly or partially by the fire of the furnace, and receives its supply of lead, as above specified.

"I also claim the combination of the air

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chamber with the forcing cylinder, and the pipe former, in the manner and for the purpose or objects as above specified.

"I also claim the arrangement of the air chamber, within, or partially within, the melting cistern or cisterns, for the purpose of melting any lead which at any time may congeal, or may have congealed, within the said air chamber, the said lead being rendered fluid by means of heat proceeding from the molten lead of the kettles, and passing through the sides (or a portion thereof) of the air chamber."

The cylinder from which the lead is to be forced is surrounded by a furnace, and provided with a piston to make the force pump double acting, and on each side of the cylinder, and partly within the furnace, is placed a melting kettle, the two communicating by apertures with the cylinder, which is also connected with an air vessel above, from which projects the tube or die with a core within for forming the pipe.

As the piston moves in one direction, the pipe leading from the cylinder to the air vessel is open, which permits the molten lead to pass into the air vessel, and by the elasticity of the air is forced through the die, the opposite end of the cylinder being in the mean time supplied with lead from the other kettle preparatory to its operation on the return of the piston.

A Machine for Writing, called the "Chirographer." *Charles Thurber.*

The patentee says,—"The nature of my invention consists in communicating to a pen or pencil holder, the motions necessary to delineate any and all letters or other characters, by motions at right angles to each other, obtained by sets of cams, each set being so formed as to combine the right angle movements, and thus generate the vertical, horizontal, oblique, and curved lines required to delineate the letters or characters. Each set of cams is actuated by a separate and distinct lever or handle, as in a pianoforte, and the table with the paper, &c., caused to move forward the required distance at the termination of each letter or character by the return motion of the lever or handle."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is communicating the motions to the pen or pencil by means of cams acting on frames, so that the vertical and horizontal strokes can be given by separate movements, and the oblique and curved strokes by the combined action of the two, substantially as herein described.

"And I also claim giving to the sheet of paper, or other substance to be written upon, a horizontal movement for spacing off the letters, and a vertical movement for the lines, in combination with the movements of the pen or pencil, substantially as herein described."

Improvements in Machinery for Manufacturing Shirred India Rubber Goods. *James Bogardus.*

The patentee says,—"The nature of my improvement consists, first in making the rollers between which the fabric is formed, of metal or other hard substance, with their surfaces grooved in the direction of their periphery, to correspond with the number and size of the India rubber strips and the spaces between them, the strips passing in the grooves, and the two pieces of cloth being pressed together between them by the ridges, and the grooves being of such depth as to insure sufficient pressure to cause the pieces of cloth to adhere to the pieces of India rubber. And, secondly, in connecting the feed rollers, (which supply the strips of India rubber at a velocity less than the passage of the completed fabric between the grooved rollers to distend them,) with the gearing which communicates the feeding motion by means of a ratchet to admit of turning back the feed rollers at the commencement of each operation, for the purpose of distending the strips between the feed rollers and the grooved pressure rollers."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method herein described, of uniting the various parts in making shirred or corrugated India rubber fabrics, by passing the cloth and strips of India rubber between pressure rollers, one or both of which is grooved in the manner described to receive the strips of India rubber, and make pressure on cloth between the strips, as herein described.

"And I also claim connecting the driving feed roller with the gearing which drives it, by means of a ratchet, to admit of turning it back to stretch the strips of India rubber, when this is combined with pressure rollers, the peripheries of which move with greater velocity than that of the feed rollers, as herein described."

A Machine for Slitting India Rubber. *James Bogardus.*

The patentee says,—"Instead of attaching the cutting wheels to the shafts permanently, they are put on by means of a feather so as to turn with the shafts and yet slide thereon freely; in this way the edges of the two series where they pass between each other, can be kept in close contact by the turning of a nut on the end of one of the shafts, for the turning of this nut must of necessity act on all the wheels of the two series.

"I am aware that a series of cutters, or discs, have been secured on a shaft by means

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of a nut, and therefore I wish to be distinctly understood that I do not claim this as my invention; but what I do claim as my invention, and desire to secure by letters patent, is the method herein described of adjusting the cutter edges of two series of cutting wheels, which fit between each other, by having each series to slide endwise on a shaft, so that the edges of the two series can be forced into contact by a nut, wedge, spring, or other analogous device, as herein described."

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 166.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

Kenneth M'Culloch, of the Minories, within the liberty of the Tower of London: specification for "A mariner's compass on a new construction." Aug. 12, 28 Geo. 3; Sept. 11, 1788.

James Cook, of Ardwick, clerk: specification for "Several improvements on a machine formerly invented by the specifier for ploughing and drilling land, and therein planting or sowing all sorts of grain, pulse, and seeds mixed, with or without pulverized manure, and harrowing the same; which improvements render the machine more perfect, and may also be used for horse-shoeing and other purposes." Aug. 12, 28 Geo. 3; Sept. 12, 1788.

Thomas Paine: specification for "A method of constructing of arches, vaulted roofs, and ceilings, either in iron or wood, on principles new and different to anything hitherto practised, by means of which construction, arches, vaulted roofs, and ceilings may be erected to the extent of several hundred feet beyond what can be performed in the present practice of architecture." Aug. 26, 28 Geo. 3; Sept. 25, 1788.

John Isherwood, of Farr House, in the township of Grindleton, in the West Riding of York, yeoman: specification for "A certain improvement on all carriages, coaches, chaises, carts, &c., but especially carriages with two wheels, consisting of a new invented lock or drag that acts in a superior manner to anything hitherto used or known." Sept. 12, 28 Geo. 3; Sept. 30, 1788.

James M'Donald, of the city of Bristol, breeches-maker: specification for "A method of making all kinds of breeches on a construction entirely new." Aug. 29, 29 Geo. 3; Sept. 28, 1789.

George Lyde, of Rathbone-place, in the parish of St. Mary-le-Bone, (Middlesex:) specification for "A coach trumpet," to supersede the use of the check string, &c. Nov. 10 last; Dec. 9, 1789.

James Stuard, of Wapping, (Middlesex:) specification for a method of reducing friction to its least degree, applicable to pulleys or blocks, pumps, engines for extinguishing fire, steam engines, and capstans. March 31, 30 Geo. 3; April 16, 30 Geo. 3, 1790.

James Wood, of Newington, (Surrey,) mathematical instrument maker: specification for an invention of machines for washing and wringing of linen, woollen, wool, cotton, silk, or any other commodity that requires washing, cleansing, or scouring. April 21, 30 Geo. 3; May 20, 1790.

John Whitworth, of Deretend, in the township of Birmingham, (Warwick,) dye sinker: specification for an invention of plating silver upon pure or block tin, and of making or manufacturing therewith by a new mode all sorts of silver plated goods or wares usually manufactured from gold, silver, or other metals, or metal plated with gold or silver. July 8, 30 Geo. 3; Aug. 6, 1790.

John Besant, of Millbank-row, Westminster, coach-maker: specification for a new invented carriage, so constructed as to save in the labour of horses, to be less destructive to roads, and better calculated for the conveyance of merchandize and the accommodation of passengers, than any now in use. July 28, 30 Geo. 3; Aug. 25, 1790.

William Kendall, of Knightsbridge, (Middlesex,) gent.: specification of a machine for washing, cleansing, and scouring all sorts of linen, cotton, or woollen apparel and household furniture that generally require to be washed, cleansed, or scoured by families at home, constructed so as to save considerable labour and expense. Dec. 8, 31 Geo. 3; Jan. 7, 31 Geo. 3, 1791.

James Beesley, of St. Giles-in-the-Fields, (Middlesex,) silver plate and coach founder: specification for an invention of plated pokers, tongs, and shovels, (commonly called fire-irons,) and fenders of all patterns. March 3, 31 Geo. 3; April 2, 31 Geo. 3, 1791.

Richard Gorton, of Cuckney, near Mansfield, weaver: specification for an invention of a loom or machine to weave all sorts of woollen, linen, cotton, and silk goods, and which will work one or several pieces at the same time, either by hand, lath-pole, steam engine, or water machinery. May 11, 31 Geo. 3; May 30, 31 Geo. 3, 1791.

James Parker, of Christchurch, (Surrey,) gent.: specification of a new method of burning bricks and tiles, and calcining chalk,

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earth stone, and lime stone, with a certain material never before made us of for that purpose. [Peat or bog as fuel.] May 17, 31 Geo. 3; June 16, 31 Geo. 3, 1791.

Ferguson Hardie, of Weymouth-street, (Middlesex,) gent.: specification of an improvement or improvements upon the construction of the machine now generally used for mangling or pressing of linen, and commonly called a mangle. Sept. 12, 31 Geo. 3; Oct. 12, 31 Geo. 3, 1791.

John Antes, of Fulneck, near Leeds, gent.: specification of an improvement in all kinds of locks, latches, and bolts that strike and catch by means of a spring. Nov. 3, 32 Geo. 3; Nov. 5, 32 Geo. 3, 1791.

Richard Banks, of Dawley, (Salop,) engineer: specification of an invention of a certain engine or machine for saving expense in sinking shafts on coal and other mines, and for lessening the risk of loss of coal, and danger attending the falling of the same from the top of such shafts. Oct. 31, 32 Geo. 3; Nov. 29, 32 Geo. 3, 1791.

James Sturman Searles, of Sheepy-yard, in the liberty of the Tower of London, (Middlesex,) gunsmith: specification of improvements on the trigger of a gun, for the better discharging and securing of all sorts of fire-arms in general. Nov. 28, 32 Geo. 3; Dec. 24, 1791.

George Lyde, of Newman-street, St. Mary-le-Bone, esq.: specification of a new invented luthern, or India summer hat for men, to prevent pressure on the forehead, and thereby prevent headache. Nov. 28, 32 Geo. 3; Dec. 27, 1791.

James Burn, of Alnwick, hatter: specification of a new composition for the making of hats. March 2, 32 Geo. 3; March 19, 32 Geo. 3, 1792.

Thomas Hayes, of Wood-street, London, calico glazier: specification of improvements upon the construction of the machine usually called a mangle, for the pressing of linen and other articles. May 19, 32 Geo. 3; June 19, 32 Geo. 3, 1792.

Philip le Brocq, of 3, Lamb's-buildings, Temple, clerk, A.M.: specification of an invention of a portable mangle or machine for mangling, smoothing, and pressing all kinds of manufactured silks, linens, cottons, woollens, papers, and wearing apparel, and every other thing which it may be necessary to smooth, press, or mangle. July 5, 32 Geo. 3; July 27, 32 Geo. 3, 1792.

James Rymer, of Paternoster-row, in the city of London, surgeon: specification of a new invention of a cardiac and nervous tincture. July 24, 32 Geo. 3; Aug. 22, 32 Geo. 3, 1792.

Clement Taylor and *George Taylor*, of Maidstone, (Kent,) esqrs.: specification of a new method of decomposing or removing all sorts of colours in linens and cottons, and for whitening all other kinds of linens and cottons in different stages of the paper manufactory. April 25, 32 Geo. 3; Aug. 24, 32 Geo. 3, 1792.

Richard March, of Barnstaple, manufacturer: specification of an improvement upon the butter-churn for the more expeditious making of butter, and preventing its becoming rancid or oily in the process. Oct. 18, 32 Geo. 3; Nov. 2, 1792.

Rowland Jones, of Greenwich, (Kent,) merchant: specification of new invented engines or machines for stamping and striping woollen cloths, kerseymeres, silk velvets, cotton velvets, velveteens, velverets, and thicksets. March 25, 33 Geo. 3; April 24, 33 Geo. 3, 1793.

William Scott, plumber, and *George Gregory*, tin-plate worker, both of Edinburgh: specification of a method of heating the water and stuff in vats for making paper by steam, being a principle entirely new. Aug. 16, 33 Geo. 3; Aug. 31, 1793.

William Warden, of Shelburne, in the province of Nova Scotia, in North America, trader: specification of a new invented extract or preparation of or from bark [for the purposes of tanning, instead of bark in the rough.] Oct. 2, 33 Geo. 3; Nov. 1, 1793.

William Taylor, of the Old Park, in the parish of Dawley, (Salop,) forgeman: specification of a new invented air-furnace on an improved construction, more simple in its principle and mechanism, and less expensive in working and consumption of fuel, and productive of a greater proportionable effect than any other hitherto discovered [wherein no blast is wanted, and iron of the same quality and quantity as that made by this invention, cannot be made with pit coal without blast, less fuel is consumed, pit coal being used in its raw state, and whereby iron is made with less waste, in greater quantities, and of a better quality from the pig to the nail rod, than by any other process now in use.] Nov. 6, 34 Geo. 3; Nov. 28, 34 Geo. 3, 1793.

Daniel Dakeyne, of Knabb-house, Derby, esq.: specification of an entirely new machine, denominated (by the specifier) an Equalinum, to be applied to and used with rollers, wheels, or any other instruments, for the purpose of preparing and spinning of flax, hemp, tow, wool, Jersey hair, or any other animal, vegetable, or fossil substance into yarn or thread. Sept. 16, 33 Geo. 3; Feb. 19, 34 Geo. 3, 1794.

William Sladen, of Sherborne, (Dorset,) innkeeper: specification of an invention of a certain machine or certain machinery for

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the removing and conveying of earth, stones, mud, sand, ballast, or any other articles, materials, or things on level ground, and for emptying, raising, and conveying the same from, or out of canals, rivers, ponds, foundations of houses, cellars, pits, or holes, and also for lowering and conveying the same from eminences and heights, and which is applicable to various other purposes. July 29, last; Aug. 23, 34 Geo. 3, 1794.

John Prosser, of Bark-hill, Holborn, (Middlesex,) whitesmith: specification of an improvement on smoke jacks [by without they will go a long time with once oiling, which may be done by any person without going up the chimney]. Sept. 8, 35 Geo. 3; Oct. 6, 1795.

John Gregory Hancock: specification of an invention of making the uprights and cross-bars for sash windows, or any other windows or lights, as well as panels for doors, frames for pictures, fences for pleasure grounds, on a new construction [of metal.] Oct. 15, instant; Oct. 24, 35 Geo. 1795.

Edward Thomas Jones, of Bristol, accomptant: specification of an invention of a new, speedy, and effectual method, or plan, for detecting errors in accounts of all kinds, and; whereby such accounts will be kept and adjusted, in a much more regular and concise manner, than by any other method hitherto known [an improved method of book-keeping.] Jan. 26, 36 Geo. 3; Feb. 22, 1796.

Henry Clay, of Birmingham, esq.: specification of a method of making a carriage, or machine, for the conveyance of, and for the shooting and discharging thereout, coals, lime, soil, manure, stones, gravel, sand, rubbish, and other materials, on a construction entirely new. [Two separate and distinct bodies on one and the same frame, each body acting separately on axles for the better convenience of shooting its load.] Feb. 27, 36 Geo. 3; March 10, 1796.

John Johnson, of Tildsley-banks, in the county palatine of Lancaster, clerk: specification of a new invented method, or plan, for preventing and curing smoking chimneys. May 3, 36 Geo. 3; May 10, 1796.

John Ching, of Launceston, (Cornwall,) chemist and apothecary: specification of a medicine [lozenges] for the destroying of worms, which may be administered without prejudice to the constitution of the patient. June 28, 36 Geo. 3; July 11, 1796.

James Murphy, of Hertford-street, in the parish of St. Pancras, (Middlesex): specification of various improvements in the art of tanning all manner of hides and kins, and in the construction of tan pits, or vats, with several utensils appertaining to the same, consisting in, 1stly. The manner of constructing the tannery, with the several utensils for heating the same. 2ndly. The manner of preparing an alkaline ley, to be used as a menstruum in tanning. 3rdly. The manner of extracting an astringent liquor, or ooze, from certain vegetable substances (named.) 4thly. The manner of concentrating the said astringent liquor. And 5thly. The manner of combining the astringent particles of the ooze, with hides and skins, so as to produce leather of a superior quality, in a very short time. Jan. 27, 37 Geo. 3; July 26, 1797.

Charles Baker, of the city of Bristol, seedsman: specification of a certain method to prevent the smut in wheat. Oct. 11, 37 Geo. 3; Oct. 14, 1797.

Henry Clay, of Birmingham, (Warwick,) esq.: specification of a certain method of saving part of the water now lost in passing of boats and barges through locks on navigable canals. Feb. 1, 38 Geo. 3; Feb. 27, 1798.

Walter Taylor, of Portswood Green, (Southampton,) esq.: specification of a considerable improvement in the construction of machines for raising water in, and for clearing ships of the same. Also to take off the pressure of the atmosphere, or eddy winds, from the tops of chimneys, to prevent what are called smoky chimneys. Feb. 28, 38 Geo. 3; March 16, 1798.

Thomas Rowntree, of Great Surry-street, Blackfriars-bridge, in the parish of Christ Church, (Surry,) engine-maker: specification of a new method of applying fire for the purpose of heating of boilers and other vessels where heat is required, and which may also be applied to other useful purposes. May 1, 38 Geo. 3; May 31, 1798.

Peter Boileau, of Bruton-street, in the parish of St. George, Hanover-square, (Middlesex,) manufacturer: specification of a new and improved manufacture of straw into hats and bonnets, and other articles, in a manner, and to produce an effect never before attempted. May 3, 38 Geo. 3; June 1, 1797.

John Champion, of the city of Bristol, manufacturer of brass, copper, and iron wire: specification of an improved method of making wire from roll and slit iron, either foreign or English, put in operation by various powers now in practice. June 2, 38 Geo. 3; June 18, 1798.

John Cochran, yarn merchant in Paisley: specification of a new invention of a method of spinning flax, hemp, and tow, by means of machinery wrought by water (or other motive power) the spinning being done at much less expense, and much more expedi-

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tiously than it can be done in any other way hitherto practised. Aug. 7, 1798; Aug. 25, 1798.

Benjamin Douglas Perkins, of King-street, Covent-garden, A.M.: specification of a discovery of a certain art of relieving and curing a variety of aches, pains, and diseases in the human body, by drawing over the parts affected, or those contiguous thereto, in certain directions various pointed metals, which from the affinity they have with the offending matter, or from some other cause, extract or draw out the same, and thus cure the patient. March 10, 38 Geo. 3; Sept. 10, 1798.

William Hart, of the parish of St. James, Westminster, (Middlesex,) brazier: specification of certain improved methods of raising of beer, ale, spirituous liquors, &c., from the cellar to the bar, or any other part of the house, for the use of publicans, brewers, distillers, and others, together with, and by means of sundry new or improved apparatus necessary for that purpose. Dec. 17, 39 Geo. 3; Jan, 4, 1799.

Edward Shorter, of Giltspur-street, in the city of London, clockmaker, and *William Anthony*, of the parish of St. John, Clerkenwell, (Middlesex,) watchmaker: specification of a new and improved method of easing, equalizing, and facilitating the draught of carriages of every description, and for easing the body of carriages of every description in the hanging of the same, and for the more securely fixing tents and marquees, and preventing the inconvenience attending the present mode of fixing the same, and which invention is likewise applicable to other useful purposes. Nov. 10, 39 Geo. 3; Jan. 9, 39 Geo. 3, 1799.

John Randall Peckham, of the parish of St. Mary, Magdalen, Bermondsey, (Surry,) watchmaker: specification of a new and improved method of constructing a watch, so as to unite it with a mariner's compass, in such a manner as to answer every purpose, with equal accuracy and perfection, for which either of them may be separately used. Dec. 17, last past; Jan. 14, 1799.

Thomas Ovey, of Fleet-street, in the parish of St. Dunstan-in-the-West, in the city of London, hatter, and *John Jepson*, of Duke-street, in the parish of St. Saviour, Southwark, (Surry,) hat manufacturer: specification of a new or improved method of manufacturing hats [felt hats.] Dec. 24, 39 Geo. 3; Jan. 24, 1799.

Stephen Halladay, of the parish of St. Martin-in-the-Fields, Middlesex: specification of a new invention for the draught or moving of carriages of all descriptions, that move on wheels, or anything that may be used for the draught or moving of carriages, adding or diminishing more or less wheels than the present mode, axle-tree, linch-pin, and every part of the carriage being on a new principle; the power which is applied for the above action is entirely new, and may be applied to the above by the assistance of men or horses, and is equally applicable to mills of all descriptions, barges and boats on canals, printing, and calendering of linen, and may also be applied to various other purposes. Aug. 3, 38 Geo. 3; Jan. 31, 1799.

John Kent, of the town and county of the town of Southampton, architect and builder: specification of a new or improved method of applying power to the working of mills and other machinery where power is required, (on the principle of the inverted lever.) Jan. 5, 39 Geo. 3; Feb. 4, 1799.

Joseph Barton, late of Old-street, in the parish of St. Luke, (Middlesex,) chemist, but now of Berners-street, in the parish of St. Mary-le-Bone, (Middlesex,) M.D.: specification of a discovery of a medicine or chemical preparation, denominated (by the specifier) Compound Concentrated Fluid Vital Air, of great use in the cure of all putrid diseases, feverous, scrofulous, or scorbutic, as well as asthmatic, paralytic, and nervous complaints; and founded on the same basis of discovery, another preparation called Aërated Preventative Fluid, as a preventative from putrid, morbid, or virulous infection; and also founded on the like basis of discovery, Aërated Liquid Balm for the preserving and beautifying the skin. Jan. 28, 38 Geo. 3; Feb. 28, 1799.

Joseph Tidmarsh, of Elizabeth-street, Hans-place, in the parish of St. Luke, Chelsea, (Middlesex,) glazier and painter: specification of a discovery of an article which may be used alone, as a substitute for paint, or mixed with paints in general, for the purpose of enlarging their quantity, and reducing their price. Feb. 28, 39 Geo. 3; March 19, 1799.

Robert Hindmarsh, of Walworth, (Surry,) printer: specification of a new method of applying an elementary or physical power to blast furnaces, and all other works where power is required. [The hydrostatic principle.] Nov. 27, 39 Geo. 3; March 23, 1799.

Michael Logan, of Paradise-street, in the parish of St. Mary, Rotherhithe, (Surry,) engineer: specification of a new invented centrifugal barrel engine, of central force, for raising water and great weights, from great depths, and applicable to all manufactories or systems of machinery, either great or small, requiring the action of circular motion, such as an effectual power in millwork, water-works, and clock-work. March 8, 39 Geo. 3; April 8, 1799.

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William Brodum, of the parish of Christchurch, (Surry,) doctor of physic: specification of a discovery of a medicine called (by the specifier) Dr. Brodum's Botanical Syrup, for the cure of scorbutic, leprous, and scrofulous complaints, and various other diseases to which the human body is subject; and also a medicine denominated Dr. Brodum's Nervous Cordial, for the cure of consumptive, nervous, and debilitated constitutions, and people who have been in hot countries, and many other complaints to which the human body is likewise subject. April 10, 39 Geo. 3; April 27, 1799.

Joseph Boyce, of Pineapple-place, in the parish of St. Mary-le-Bone, (Middlesex:) specification of an invention of a machine for cutting [reaping] of wheat, and all other corn. July 4, 39 Geo. 3; Aug. 3, 1799.

Edmund Prior, of Brook-street, Holborn, in the united parishes of St. Andrew, Holborn, and St. George the Martyr, (Middlesex,) leather seller: specification of an invention for painting and colouring all kinds of leather, in all colours, in a manner perfectly new, by laying on such a body of colour that the leather so painted will be quite elastic and soft, with a pleasant smell, and preserve its tints after being wet or dirty; it may be washed with a sponge and cold water, without fading in parts, or becoming of different colours, yet without being subject to crack. Nov. 4, 40 Geo. 3; Nov. 15, 1799.

Thomas Binns, of Great Barlow-street, in the parish of St. Mary-le-Bone, (Middlesex,) water-closet maker: specification of an invention of a machine or apparatus answering the several purposes of a portable water-closet, &c., which together are comprised in one third of the space or room occupied by portable water-closets now in use, and which from its lightness and size is particularly calculated for travelling, or for camps and ships. Nov. 4, 40 Geo. 3; Dec. 3, 40 Geo. 3.

Edmund Edward Ludlow, of Walworth, (Surry:) specification pursuant to patent granted to the said *E. E. Ludlow* and *Ann Wilcox*, for new or improved playing cards, called (by the patentees) "Brilliant new invented Knight's Cards." Dec. 20, 40 Geo. 3; Jan. 17, 1800.

Joseph Smith, of Castle-street, in the parish of St. Martin-in-the-Fields, (Middlesex,) gent.: specification of certain new improvements in the internal bracings of pianofortes, so as to admit the introduction into the internal part of the instrument of a drum, tabor, or tambourine, with sticks or beaters thereunto belonging, together with other improvements thereon. Oct. 3, 39 Geo. 3; Feb. 3, 1800.

James Carter Hornblower, of John's-row, City-road, in the parish of St. Luke, (Middlesex,) engineer: specification of an invention of a new machine for, and method of, glazing calicoes, cottons, muslins, &c. Feb. 4, 40 Geo. 3; March 3, 1800.

William Bolts, late of Aldgate, but now of Cannon-street, London, gent.: specification of an invention of various new methods of making and improving the form, quality, and use of candles, and other lights made of tallow, wax, spermaceti, or any other solid inflammable substances. Embracing the four following principles: 1. The fabrication of the body of such candles or lights, previous to and independent of the wicks; which may be afterwards applied to them. 2. The application to such candles or lights after their fabrication of movable wicks, which can be applied to or extracted from them at pleasure. 3. The application to such candles or lights of fixed or ordinary wicks, at any time after the fabrication of either. 4. The placing the inflammable substance, while in fusion, in a close vessel, and there submitting it successively to the action of a vacuum, and of a pressure, superior to that of the atmosphere, which is done in the double view of extracting, by the vacuum, any elastic fluid that may remain hid in it under the ordinary pressure, and of increasing the solidity and whiteness of the substance, by the superior pressure applied to it while cooling. Sept. 26, 39 Geo. 3; March 24, 1800.

John Marshall, of Gerrard-street, in the parish of St. Ann, Soho, (Middlesex,) cabinet maker and upholder: specification of an invention of dining and other tables on an improved construction, [telescope tables, &c., on one or more pillars.] April 29, 40 Geo. 3; April 30, 1800.

William Collins, of Greenwich, (Kent,) esq.: specification for an invention of "A preparation or application of sundry articles and materials to be used chiefly for the preservation of shipping or marine purposes," viz. the application of mixtures of various metals, as a substitute for copper sheets in sheathing; the application of certain metallic mixtures as a substitute for iron in the several parts of the chains and saucers of the chain pumps, usually called Cole's Chain Pump; as well as various other improvements in the said chain pumps (described); and the application of the said several mixed metals to the covering of houses. April 23, 40 Geo. 3; May 16, 1800.

John Whitton, of the town and county of the town of Kingston-upon-Hull, merchant: specification of an invention of a lead sac-

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charum, for the use of calico printers, and several other useful purposes. May 10, 40 Geo. 3; June 4, 1800.

Robert Meares, of Frome, (Somerset,) dyer: specification of a machine for cutting after a new method standing corn, grass, and the like, and for making reed, and which machine may also be applied to other useful purposes. May 20, 40 Geo. 3; June 14, 1800.

Peter Davey, of the parish of Christchurch, (Surry,) coal merchant: specification of an improved fuel. May 20, 40 Geo. 3; June 19, 1800.

William Weller, of Cavendish-street, Cavendish-square, (Middlesex,) gent.: specification of "An invention of manufacturing, forming, making, and engraving copper plates for printing policies to secure persons from loss of property of certain descriptions," to wit, to insure property in cases of burglary, robbery, theft, &c.

"The effecting this great and most desirable object appears to have been reserved for the patentee, who by great labour and expense is the whole and sole inventor and founder of this grand and long-wished for design, and for which his majesty has been most graciously pleased to grant his royal letters patent to *William Weller* for making copper-plate engraved policies to secure his majesty's subjects from loss of property of certain descriptions." June 17, 40 Geo. 3; June 25, 1800.

George Harris, of Banners-street, Bunhill-row, in the parish of St. Luke, (Middlesex,) working goldsmith: specification of an invention of boxes for snuffs, essences of all kinds, and other purposes. July 1, 40 Geo. 3; July 31, 1800.

Thomas Penn, of the town and county of the town of Nottingham, mechanic: specification of a new mode of sinking, locking up the jacks, pressing, drawing back the needle-bar, and keeping up the jacks in frames, for the more simple and expeditious frame-work knitting of silk thread, cotton, and worsted. July 24, 40 Geo. 3; Aug. 8, 40 Geo. 3, 1800.

Innocenzo della Lena, of Piccadilly, (Middlesex,) doctor of physic and surgeon: specification of a medicine called "Phlogistical and Fixed Earth of Mars, or Powder of Mars." Aug. 2, 40 Geo. 3; Aug. 19, 1800.

Henry Cundell, the younger, of the Minories, in the city of London, Druggist: specification of a certain composition called Cundell's Myoctonus, for destroying of rats and other destructive vermin. July 26, 40 Geo. 3; Aug. 26, 1800.

George Medhurst, of Battle-bridge, in the parish of St. James, Clerkenwell, (Middlesex,) engineer: specification of a new method of driving carriages of all kinds without the use of horses, by means of an improved æolian engine, and which engine may also be applied to various other useful purposes [the power applied to the machinery being compressed air, and the power to compress the air being obtained generally by wind, &c.] Aug. 2, 40 Geo. 3; Sept. 1, 1800.

Thomas Binns, of Great Barlow-street, in the parish of St. Mary-le-Bone, (Middlesex,) water-closet maker: specification of an invention of a new and improved method of applying heat for the purpose of melting and manufacturing animal fat, and a variety of other solid substances, whereby the quality thereof is materially preserved and improved, by which invention these substances can be manufactured and prepared with much less waste and manual labour, and with a smaller quantity of fuel than by any method now in use, with a less offensive effluvia, and without the danger which always attends the common method of melting and manufacturing solid inflammable substances. [Through the medium of steam. The process used in this invention may likewise be successfully employed in distillery.] Oct. 27, 41 Geo. 3; Nov. 26, 1800.

Lawson Hudelston, of Shaftesbury, (Dorset,) esq.: specification of a method of conveying boats or barges from a higher level to a lower, and *vice versâ*, on canals, by the immersion of a plunger or plungers. Dec. 30, last past; Jan. 23, 1801.

John Longman, of Penton-street, Pentonville, in the parish of St. James, Clerkenwell, (Middlesex,) organ builder: specification of certain new improvements in the construction of barrel organs, to prevent them from getting out of order, and another musical instrument or instruments may be internally united or attached thereto, and made to play with the same barrel. Jan. 27, 41 Geo. 3; Feb. 25, 1801.

George Medhurst, of St. James, Clerkenwell, (Middlesex,) engineer: specification of an invention of a compound crank for changing a circular motion into a rectilinear one, and *vice versâ*, which is applicable to various mechanical purposes. Jan. 27, 41 Geo. 3; Feb. 26, 1801.

Robert Young, of the city of Bath, (Somerset,) ironmonger: specification of an improved fire stove or grate, applicable to register, half register, forest, Rumford, Pantheon, or any other kind of stove or grate. Feb. 3, 41 Geo. 3; March 3, 1801.

Thomas Binns, of Great Barlow-street, in the parish of St. Mary-le-Bone, (Middlesex,) water-closet maker: specification of a new

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and improved method of manufacturing candles of wax, spermaceti, tallow, or any other solid inflammable substance, whereby such candles will be of much greater durability, and will give a more steady and brilliant flame; such substances to be melted through the medium of steam instead of the direct action of the fire. April 23, 41 Geo. 3; May 23, 41 Geo. 3.

Richard Willcox, of the city of Bristol, engineer: specification of "Several valuable improvements upon the fire or steam engine and furnace," viz.: 1. Modes or methods of increasing the product of steam without adding to the consumption of fuel. 2. An addition to the chimney flue of a furnace, by which the descent of the smoke and heated matter to a lower level than that of the fire-place is regulated and adjusted at pleasure. 3. Certain new arrangements and constructions of the parts of the steam engine, by which its power and effects are greatly increased. April 30, 41 Geo. 3; May 30, 1801.

John Edwards, of Chelsea, in the parish of St. George, Hanover-square, (Middlesex,) gent.: specification of an invention of collars for horses to draw by on an improved construction, in which the draught or purchase is affixed to the outside shapes, and not to the hames, and there is no pressure upon the shoulder bone of the horse. May 2, 41 Geo. 3; June 2, 1801.

Thomas Witherby, of Enfield, (Middlesex,) gentleman: specification of "an improved pump and method of working machinery," consisting in the application of machinery for the purpose of applying the water discharged by the pump, and using the same water as a power whereby to work the pump, and in the application of the same principle and the power gained thereby for the purpose of working machinery, &c. June 23, 41 Geo. 3; Aug. 27, 1801.

William Parkes, of Newington, (Surry,) professor of philosophy: specification of an invention of a perpetual power that will give motion to all kinds of machinery, mills, engines, carriages, ships of war, mercantile and other vessels, lighters, crafts, and boats of every description [compressed air.] Aug. 20, 41 Geo. 3; Aug. 18, 1801.

Barker Chifney, of the city of London, gentleman: specification of an improved method of preparing and laying diamond and other slates in covering houses and other buildings, and of preparing slates for other purposes. May 2, 41 Geo. 3; Oct. 30, 1801.

William Robinson, of Essex-street, in the parish of St. Clement Danes, (Middlesex,) peruke-maker; specification of a method of making perukes and scalps so as more to resemble nature than those made in the ordinary way, and which improvement may also be applied to a variety of other useful articles, [such as articles made with hair, fur, or wool, intended to imitate nature.] Nov. 10, 42 Geo. 3; Dec. 8, 1801.

Robert Dickinson, of Long-acre, (Middlesex,) gentleman: specification of certain improvements in the construction of and additions to the saddles, harness, and other gear, necessary or useful for the employ of horses and other carriages in riding or in carrying loads, or in drawing carriages of any description whatever [by the application of metal springs, or India-rubber, and thereby producing elasticity.] Nov. 10, 42 Geo. 3; Dec. 9, 1801.

James Sharples, portrait-painter, of Lansdown Place, Bath: specification of "New invented arrangements of implements and mechanical powers applicable to steam engines, part of which machinery may be applied to other useful purposes," viz.: 1. Certain arrangements of implements and mechanical powers for the purpose of giving motion to rollers and drum wheels within cylinders or parts of cylinders, by means of the same portion or body of water, or other fluid forced by the pressure of steam against the said drum wheels or cylinders, or against valves, wings, buckets, or other resisters attached thereto. 2. Certain arrangements of implements and mechanical powers for the purpose of counterpoising the atmospheric pressure upon the pistons in what is called Newcomen's Engines, by a counter pressure of atmospheric air or steam upon other pistons within cylinders, or by a counter weight upon the piston-rod at the end of a pendulum attached thereto or to the cranks of any axle. 3. Certain arrangements of implements and mechanical powers applicable to steam engines for giving motion to carriages and to vessels. 4. Certain arrangements of boilers, air-pumps, condensers, and pistons. Jan. 28, 42 Geo. 3; Feb. 15, 1802.

Charles Mercie, of the city of Bath, music master: specification of an invention of slides to be fixed to windows, doors, and partitions of all descriptions, called (by the specifier) air slides, for the purpose of excluding all air and dust. Feb. 6, 42 Geo. 3; March 2, 1802.

Robert Dickinson, of Long Acre, in the parish of St. Martin-in-the-Fields, (Middlesex,) proprietor of Gowland's Lotion: specification of a new or improved method of fixing the straps of and to saddles to which the girths are usually made fast or buckle, by means of springs, for the purpose of

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giving elasticity to the girth. Feb. 6, 42 Geo. 3; March 6, 1802.

Andrew Vivian, of the parish of Camborne, (Cornwall,) engineer and miner: specification pursuant to patent granted to *Richard Trevithick*, of the parish of Camborne aforesaid, engineer and miner, and the said *Andrew Vivian*, for an invention of methods for improving the construction of steam engines, and the application thereof for driving carriages, and for other purposes. March 24, 42 Geo. 3; March 26, 1802.

William Symington, of Kinnaird, (Stirling, N. B.:) specification of "A new mode of constructing steam-engines, and applying their power to the purposes of producing rotatory and other motions without the interposition of a lever or beam," being a principle entirely new, and applicable to impelling boats, &c. Oct. 14, 41 Geo. 3; March 9, 42 Geo. 3.

Obadiah Elliott, of the parish of St. Mary, Lambeth, (Surry,) coachmaker: specification of an invention of an eccentrical antilaborist spring curricle bar for one or more horses. March 9, 42 Geo. 3; April 8, 1802.

Archibald Thomson, of Three King-court, Lombard-street, in the city of London, engineer: specification of certain new or improved machinery for the purpose of spinning rope yarn and sail cloth yarn, and for laying or making of ropes and other cordage. Also for an improvement upon a water wheel. Nov. 10, 42 Geo. 3; May 10, 1802.

Matthew Wood, of Falcon-square, in the parish of St. Giles without Cripplegate, in the city of London, merchant: specification of an invention of a method of preparing a colour from malt for the purpose of colouring spirits, wines, and other liquors. May 31, 42 Geo. 3; June 21, 1802.

Richard Willcox, of the city of Bristol, engineer: specification of further improvements on the steam engine furnace or boiler and air pump, part of which may be applied to the manufacturing of sugar and spirits by steam, and to a variety of other useful purposes. Jan. 23, 42 Geo. 3, 1802; June 21, 1802.

John Cant, late of the town of Brechin, tanner, and *John Millar*, of the town of Montrose, tanner and leather dealer, both in the county of Angus, North Britain: specification of a new method of tanning leather, whereby a great saving will be obtained both in expense and time, and whereby a better article is produced. May 31, 42 Geo. 3; Sept. 22, 1802.

William Plees, of Chelsea, (Middlesex,) gent.: specification of an invention of certain methods of manufacturing paper for various purposes, and of applying one of the said methods to purposes for which paper hath never before been used, [*i. e.*, rendering the same elastic, and applying it to the purposes of leather.] Sept. 27, 42 Geo. 3; Oct. 26, 1802.

James Roberts, mechanic, and *Edward Brine*, coppersmith and founder, both of Portsea, (Hants:) specification of an invention of certain machinery for the purpose of drugging or locking the wheels of carriages of every description, and for instantly disengaging the horses therefrom, either with or without their traces, and for steering the carriage after the horses are so disengaged. Nov. 29, 43 Geo. 3; Dec. 24, 1802.

William Beer, of Ely-place, in the parish of St. Andrew, Holborn, in the city of London, medical professor and dealer in medicines: specification of an invention or discovery of certain new and improved medicines, and methods of administering the same, for the more effectually and expeditiously curing the gout, rheumatism, &c. Dec. 9, 43 Geo. 3; Jan. 8, 1803.

LIST OF ENGLISH PATENTS GRANTED FROM FEB. 11, TO FEB. 19, 1847.

Alfred Brett, of Holborn-bars, gent., and George Little, of High Holborn, electrical engineer, for improvements in electric telegraphs, and in the arrangements and apparatus to be used therein and therewith, part of which improvements are also applicable to time-keepers and other useful purposes. February 11; six months.

Egbert Hedge, residing at No. 7, Howard-street, in the parish of St. Clement's Danes, Middlesex, gentleman, for certain improvements in rails for railways, and in the manner of securing them. February 12; six months.

William Edward Newton, of No. 66, Chancery-lane, Middlesex, for improvements in aerial locomotion. Being a communication. February 15; six months.

Solomon Leatham, of Leeds, York, overlooker, for improvements in roving and spinning flax and other fibres. February 15; six months.

Francis Henry Waller, of Harrington-square, Middlesex, surgeon, for improvements in apparatus for making and filtering infusions of coffee and other articles. February 16; six months.

Robert Stirling Newall, of Gateshead, Esq., for certain improvements in locomotive engine.s Feb. 16; six months.

Phillip Henry Holland, of Chorlton-upon-Medlock, Manchester, for improvements in applying manure to land. Being a communication. Feb. 16; six months.

Nathaniel Card, of Manchester, twine manufacturer, for certain improvements in machinery or apparatus for twisting, twining, or manufacturing cords, bands, and other similar articles from cotton, flax, hemp, silk, and other fibrous yarns or threads. February 16; six months.

Francois Hanilas Meldon De Sussex, of Millwall Middlesex, for improvements in the manufacture,

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of chlorine hydrochloric acid and nitric acid, and obtaining several products therefrom. February 19; six months.

Alexander Bain, of Upper Baker-street, Middlesex, electrical engineer, for improvements in clocks and time-keepers, and in apparatus connected therewith. Feb. 19; six months.

Advertisements.

***On the 1st of March (ready with the Magazines)* will be published, No. I. of**

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The Second Part is entirely devoted to the THEORY and PRACTICE of the Science of Civil Engineering, comprised under the following principal heads:—

Geology, *Mineralogy*, and *Chemistry*, which define the nature and properties of the strata of the crust of the earth, are fully treated of, so far as they come within the province of the Civil Engineer.

Geometry, not only in reference to the rudiments of the Science, but Practical and Theoretical Observations on Levelling and Surveying on Land, at Sea, and in Subterranean Works, together with an account of all the instruments used for these purposes.

Mensuration of Planes and Solids, mapping, drawing, perspective; and the valuations of property, with several kinds of artificers' work.

Mechanics are described with reference to the principles, movements of machinery, construction of machines, their useful effects and application to the purposes required by the engineer; not only mills of every kind, but also the gigantic tools which have superseded manual labour, cranes and machines for lifting weights, pile-driving, dredging, &c.

Hydraulics, or the motion of fluids, with accounts of the machines employed for pumping, raising, and distributing water; their powers, construction and useful effect.

The Atmosphere, as a moving power, is fully described with reference to windmills, blowers, ventilators, &c.

Warming, *Lighting* and *Ventilating* public and private buildings, with the apparatus used for these important purposes.

Steam: the several parts of engines; their variety, general principles, and utility; the Locomotive and its construction.

Timber, its properties and employment in the art of carpentry. Bridges, roofs, centring, scaffolding, are all amply detailed, with their construction, and the strength of the several timbers employed.

Masonry is described, with reference to the construction of vaults, arches, bridges, quays, &c.; together with an account of the difficulties which occur in this practical science.

Canals, *Draining*, and *Embanking*, are each treated of; as are the various methods by which these operations are performed, their uses, &c.

Railroads, their formation, gradients, rails, planes, &c.; with observations upon the principles and policy hitherto displayed in their construction.

The Principles of Proportion, in construction, and the relation of mass and void, are fully described.

London: LONGMAN, BROWN, GREEN, AND LONGMANS.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

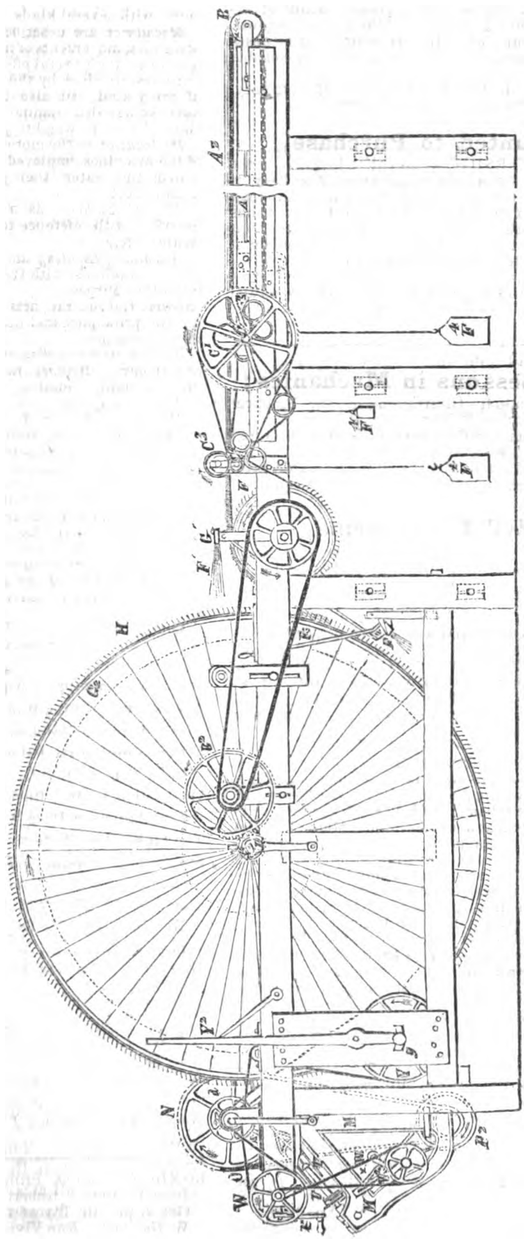
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1229.] SATURDAY, FEBRUARY 27. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

SIMSON'S FLAX DRESSING AND SPINNING MACHINERY.

Fig. 1.



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SIMSON'S FLAX DRESSING AND SPINNING MACHINERY.

[Patent dated June 20, 1846; Specification enrolled December 20, 1846.

The improved machinery, which forms the subject of this patent, has been imported from Germany, where it is much spoken of as possessing many advantages over that employed by the flax and linen manufacturers of our own country. We give this week the patentee's description of so much of it as relates to the dressing and preparing of the flax, and in a subsequent number shall give the portion relating to spinning.

Figure 1 exhibits a front elevation of a machine for preparing flax for spinning. Fig. 2 a back view thereof (partly in section) in the reverse direction of fig. 1, and fig. 3 a plan. In using this machine, the flax is subjected to two distinct operations, the parts concerned in which it will be proper, therefore, to describe here separately:

First Operation.

A A is a wooden frame-work; A^2 is an endless chain of copper, or zink bars, which turn on two cylinders, B B, forming a travelling table, on which the flax to be heckled is laid (after having been first thoroughly cleansed and scutched.) On this table the flax is gathered into four (or more) parcels, or stricks, which are conducted to the funnels, *a, a, a, a,* passing through which they are drawn between two equalized rollers, C^1, C^2, the upper of which (C^1) is made of iron covered with leather, and the under (C^2) of copper, iron, or zink, grooved. The stricks are next passed over a small carding cylinder, D, then through a second set of funnels, *b, b, b, b*; on emerging from which, they are carried under a second small carding cylinder, D^2, and thence between two rollers, C^3, C^4, of the same description as C^1, C^2. From C^3, C^4, the stricks enter a third set of funnels *c, c, c, c,* from which they pass over a large carding cylinder, F, and under a bar, G, armed with four or more obliquely fixed brushes (corresponding to the number of stricks of flax) which serve to equalize the fibres. $F^4 F^4$ are tension weights and pulleys. From the large carding cylinder, F, the stricks of flax are next passed under a combing cylinder, G^2, (see fig. 2,) where they are drawn by the needles, H, H, into fine slivers, ("bonding.") Immediately behind these needles there is a series of steel-spring pushers, or doffers, I, I, so placed as that each needle has a pusher in the rear of, but not in the same parallel with it; and until these pushers are acted upon by pressure in the manner to be presently explained, they remain in a quiescent state. On the opposite side to that at which the stricks of flax enter upon the cylinder G^2, there is fixed a crescent-shaped piece, K, which, as the spring pushers, I, I, are brought into contact with it by the revolution of the cylinder, pushes them outwards, and causes them thereby to push the slivers of flax from off the needles. The combed flax as it is thrown off the needles falls into a series of funnels, *d, d, d, d,* and passes thence to the machinery described under the "Second Operation."

The manner in which the machinery, so far as it has been described, is actuated, is as follows: A^3 A^3 are fast and loose pulleys on one end of the shaft of the large combing cylinder G^2, which by means of a clutch are put in and out of gear as required with a steam-engine or other first mover. A^4 is a pinion on the opposite end of the same axis, which takes into a cog-wheel B^2, on the axis of which there is a small wheel, which is connected by means of a pitch chain and pulley, (assisted by the guide pulleys, *f f*,) with the axis of the carding cylinder F, which in its turn commands, through the medium of a series of pitch chains and wheels (as shown), the rollers on which the travelling table A^2 revolves, as also the smaller preparing and carding cylinders C^1 C^2 C^3 C^4, and D D^2.

Second Operation.

From the funnels, *d d d d,* the slivers of flax are conducted between two drawing rollers, S S, and thence to the throstles or spindles Q Q for the purpose of being twisted into rovings. The cylinders, S S, are of unequal diameters: the larger of the two is made of copper and grooved, and the smaller of wood. The spindles, with their bobbins, are of a peculiar construction, which will be hereinafter described when treating of the machinery for spinning the flax; spindles and bobbins of the same sort being used for both operations. The delivery funnels, *d d d d,* and the spindles Q Q, with their appendages, are all attached to a separate cast-iron chase or framework, M M, suspended

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from a common shaft, M^2, which is supported by standards raised on the principal framework, A A, and is by means of a screwed-rod, R, capable of being moved to a

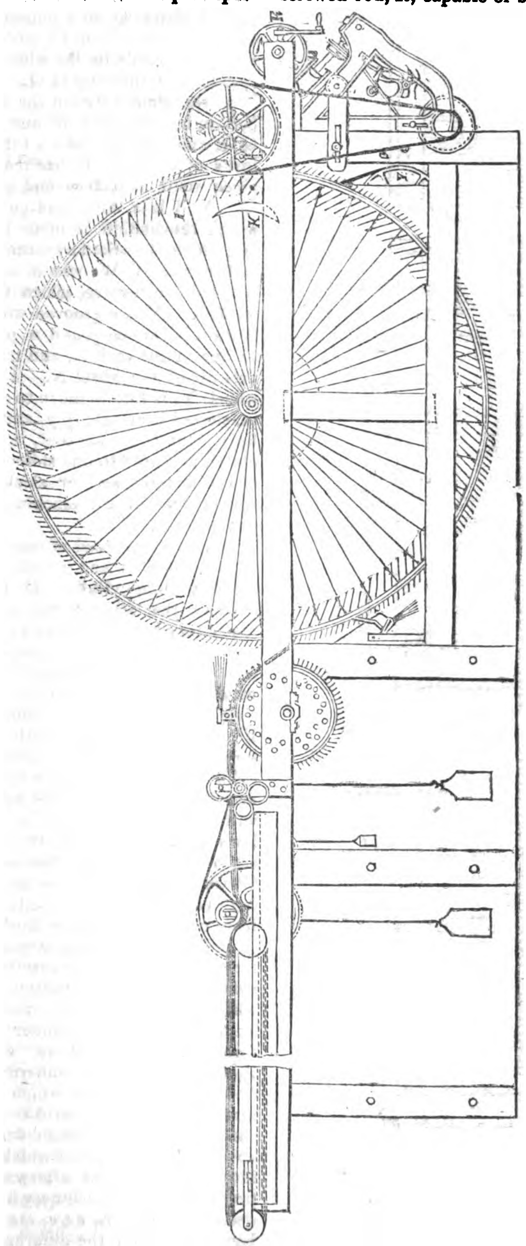

Fig. 2.

greater or less distance from the large combing cylinder G^2, according as it is flax or tow which is to be roved; that is to say, according as the filaments are long or short. N is a

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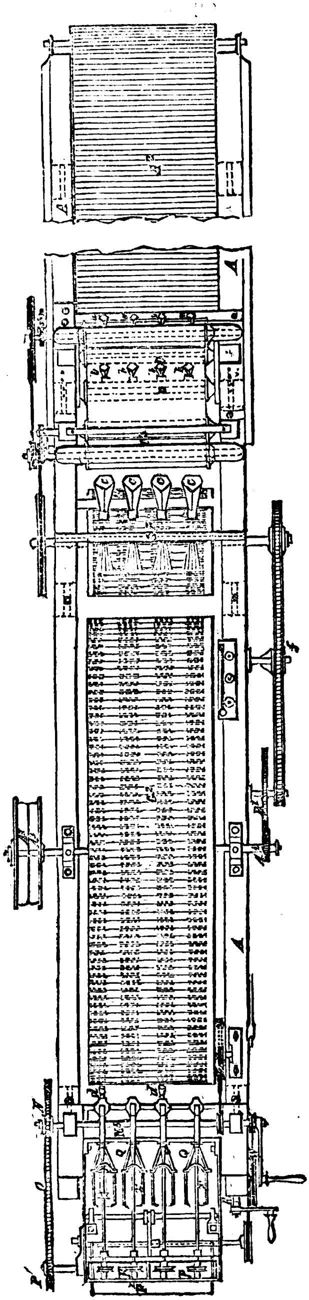
Fig. 3.



large pitched pulley (called *tête-de-cheval*) fixed on the shaft M^2, which is connected by a pitch-chain, O, to a pinion P′, on one end of the axis of a drum P^2, which again is connected by cords to the whorls, *p p*, of the spindles or throstles Q Q. Each sliver as it passes from between the drawing-rollers, S S, enters the neck of one of the spindles Q Q, and passing down a tube in one of the forks of the flyer T, has the requisite twist given to it as it is wound upon the bobbin U. X X is a come-and-go-movement, by which the bobbin is made to rise and fall, and which is worked by means of the pulleys and bands W W, which causes the dead wheel W^2 to revolve, which in its turn acts on X X. Y is a grooved wheel from which a chain is carried round a pulley y^2, affixed to the framework A, and thence round the axis M^2 of the wheel N. The axis of this wheel, Y, is free to move to a certain extent in slotted bearings, *g g*, and is commanded by a clutch Y^2, so that, according as the clutch is moved to one side or the other, the chain is tightened or slackened, and the roving part of the machinery thrown in or out of gear.

When tow, instead of flax, is the material to be prepared and roved, one of the two small carding cylinders D^1 D^2 is removed, and all the other parts of the preparing machinery brought closer together.

In order to remove from the teeth of the combing cylinder G^2 any filaments of tow which may be left from time to time adhering thereto, there is a second set of brushes F^2, affixed to a bar a little way below the point at which the flax enters upon the cylinder G^2, and which may be brought by means of the lever F^3 into as close a contact with the needles as may be required. The lever F^3 commands also the bar of the other set of brushes F^1, so that when the brushes F^2 are pressed against the teeth of the combing cylinder G^2, the brushes F^1 are raised from off the teeth of the carding-cylinder F.

In fig. 3, another arrangement is shown for the removal of the tow from the combing cylinder. A is a cylindrical brush, against which the teeth of the combing-cylinder C impinge when the cylinder revolves in the direction of the arrows, and which free these teeth from the adhering filaments. B is a carding cylinder which takes the filaments from off the brush A, and delivers them between two plain wooden cylinders covered with leather, by which they are drawn into ribands to be afterwards dressed or prepared by the machinery first hereinbefore described. E E E, *e e e*, are the pulleys and bands by which the different cylinders belonging to this arrangement are put in motion.

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1	2	3	4	5	6	7	8	9.
1	8	27	64	125	216	343	512	729.

We see there are not two cubes ending alike. And the cubes of the two extreme numbers 1 and 9, also of the three mean numbers 4, 5, 6, have the same ending as the root. Not only so, but the four numbers which remain may be divided into two pairs [2 and 8], [3 and 7]. I have coupled them above. These alternate their endings; the root 2 takes 8 in the cube; and the root 8 takes 2 in the cube for its unit. The same may be said of 7 and 3.

The unit of any cubic number will therefore at once indicate the unit of its root.

We may with the same ease and quickness determine in a cube of some millions, the figure which occupies the place of tens in the root.

It is evident that the effect of converting each digit as a root into tens, is to convert its corresponding cube into a thousand times what it was before: as

$$1^3=1,\ 10^3=1\cdot000\ .\ 2^3=8,\ 20^3=8\cdot000,$$

$$9^3=729,\ 90^3=729\cdot000\ .\ 10^3=1000,\ 100^3=1000\cdot000.$$

The cube root, therefore, of any integral number as far as a million, may be determined in its tens by any one who remembers the cubic numbers as far as ten. If the number is between one thousand and eight thousand, the figure for the place of tens must be 1: if between 8·000 and 27·000, it must be 2: if between 27·000 and 64·000, it must be 3, and so of the rest.

Examples.

What is the cube root of 262144?

As this sum ends in four the unit of the root must be 4. As the amount of the cube is between 216·000 and 343·000, the figure for the tens in the root must be 6.

Therefore the answer is 64.

What is the cube root of 571787?

Here the unit of the cube being 7 the unit of the root is 3. And the cube being between 512·000 and 729·000, the figure for the place of tens is 8.

Therefore the answer is 83.

If we learn the integral cubic numbers as far as that of 20, we may at once determine the root, as far as 8·000·000; and by learning more we may proceed as far as we like.

I cannot help thinking, that some of the feats performed by children calling themselves arithmetical boys, are accomplished in this way. A child of eleven or twelve years old, without any extraordinary capacity for figures, may be taught to apply the above rule for determining the roots of cubic numbers as far as 8 000·000. And if so, the publication of this short and easy method of extracting the roots of cubic numbers may be *useful* as well as *amusing*, inasmuch as it may abate misplaced wonder and detect trickery.

I would wish to add to what I have said, that the duodenary arithmetic which some extol as superior to the denary, has not this curious property of forming all the units of its digits different from each other; and therefore would not admit of this compendious solution for the roots of cubic numbers.

This may be seen in the following series of cubes as far as that of 12. I would premise that I have adopted (as two new digits are necessary in the duodenary system,) for ten, six reversed, δ; for eleven, nine reversed, ρ. These happen to be Greek letters, and the δ was formerly used by the Greeks for ten. Twelve must be expressed by 10, in the duodenary system.

Digits.

1	2	3	4	5	6	7	8	9	d	ρ	10

Cubes.

1	8	23	54	d5	160	247	368	509	6ρ4	92ρ	1000.

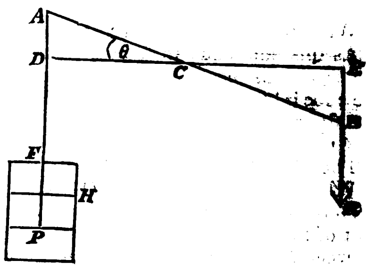
We may observe that the 2 has the same unit for its cube as 8, the 6 the same as 10, the 4 the same as *d*.

If you think what I have here sent you suitable for insertion in your Magazine, perhaps you would like more specimens of compendious solutions of arithmetical questions. If so, I shall be willing to send you some. I think I could send enough to set up any youth of moderate capacity as an Arithmetical Boy, who might make his tour with considerable success.

J.

ON THE ADJUSTMENT OF THE PARTS OF STEAM-ENGINES.

Sir,—As the letter of Mr. M'Gregor in your last Number seems to refer to points of some practical importance, perhaps the following calculation may interest your engineering readers. As one of the most important, as well as simple cases, I have taken the Cornish pumping engine, and supposed the steam worked expansively—*i. e.* the communication with the boiler kept open, and therefore the pressure on the piston continued the same for a certain portion of the stroke, and then cut off, so as to leave the rest of the motion to be completed by the expansion of the quantity already enclosed. In those engines where the crank and fly-wheel are used the calculation is very cumbersome and awkward—and, indeed, the integrations not at all manageable if strict accuracy be observed. As, however, the arc of vibration is never large, the supposition of a uniform pressure in a vertical direction at the working end of the beam, will not differ much from the reality in practice. Of course, the prevention of sudden stoppages and alterations of the motion is attended to in all carefully managed engines; but I believe the object is generally accomplished, or attempted, by making the steam undo part of its own work—viz., by stopping a moving piston, which is therefore so much waste; for example, in the "lead of the slide" in locomotives, where, however, it is but small. But that to which Mr. M'Gregor particularly alludes, is, if I mistake not, the accomplishment of the same object by carefully adjusting the proportions of the various parts; and it is to this end the following investigation refers. In the single acting engines used in the Cornish mines, where the piston cannot be stopped by the introduction of steam *beneath* it (the only regulator being the "cataract,") and where the moving mass is of such immense weight, these considerations deserve the greater attention. Indeed, in some of the older engines (cylinder 40 to 60 inches diameter) I have seen the piston come down with a *thump* truly frightful. (It must be so to the owners' pockets.)



$AC=BC=a. \quad DF=c. \quad AP=d. \quad PF=x. \quad FH=s.$

Mk^2 = moment of inertia.

α = greatest angle of vibration of the beam on each side of DE.

Suppose the steam admitted until it occupies the space FH; having a pressure on the piston = P. R = constant resistance at the working end of the beam, in a vertical direction.

Then from F to H, we have the following equation for determining the velocity:

$$\frac{d^2\theta}{dt^2} \times \mathrm{M}k^2 = (\mathrm{P}-\mathrm{R}).a \cos\theta;$$

$\therefore \left(\frac{d\theta}{dt}\right)^2.\mathrm{M}k^2 = 2(\mathrm{P}-\mathrm{R})\,a\sin\theta + \mathrm{C}$, and the velocity being nothing when $\theta = \alpha$,

$$\therefore \frac{d\theta}{dt} = \sqrt{\frac{2}{\mathrm{M}k^2}.(\mathrm{P}-\mathrm{R})\,a(\sin\alpha - \sin\theta)} \ldots\ldots (1).$$

Now let the steam be cut off when the piston is at H. Then the pressure being inversely as the space occupied by the steam, the remainder of the motion will be determined by the following equation :

$$\frac{d^2\theta}{dt^2} \times \mathrm{M}k^2 = a\cos\theta\left(\mathrm{P}\frac{s}{x} - \mathrm{R}\right).$$

$$= a\cos\theta.\left\{\frac{\mathrm{P}s}{d-c-a\sin\theta} - \mathrm{R}\right\}$$

$$\therefore \left(\frac{d\theta}{dt}\right)^2.\mathrm{M}k^2 = -2\ \mathrm{P}s.\ \log_\varepsilon(d-c-a\sin\theta) - 2\ \mathrm{R}.\ a\sin\theta + \mathrm{C}',$$

and the velocity is given by the equation marked (1) when $x = s$;

$$\therefore \mathrm{C}' = 2\ (\mathrm{P}-\mathrm{R})\ a\ (\sin\alpha - \sin\theta') + 2\ \mathrm{P}s.\ \log_\varepsilon\ (d-c-a\sin\theta').$$
$$+\ 2\ \mathrm{R}.\ a\sin\theta'.$$

θ' being the value of θ when $x = s$, and is a constant in this second part of the motion :

$$\therefore \left(\frac{d\theta}{dt}\right)^2.\ \mathrm{M}k^2 = 2\ (\mathrm{P}-\mathrm{R}).\ a\ (\sin\alpha - \sin\theta') + 2\ \mathrm{R}.\ a.\ (\sin\theta' - \sin\theta)$$
$$+\ 2\ \mathrm{P}s.\ \log_\varepsilon.\left\{\frac{d-c-a\sin\theta'}{d-c-a\sin\theta}.\right\}\ldots\ldots (2).$$

Now, in order that there may be no sudden stoppage of the motion when its direction is altered, we must have

$$\frac{d\theta}{dt} = 0 \text{ for } \theta = (-\alpha) \text{ as well as for } \theta = (+\alpha).$$

This gives us the following equation amongst the dimensions a, c, d, α, &c., of the various parts :

$$0 = 2\ (\mathrm{P}-\mathrm{R})\ a\ (\sin\alpha - \sin\theta') + 2\ \mathrm{R}.\ a\ (\sin\theta' + \sin\alpha)$$
$$+\ 2\ \mathrm{P}s.\ \log_\varepsilon.\left\{\frac{d-c-a\sin\theta'}{d-c+a\sin\alpha}\right\}\ldots\ldots\ldots (3).$$

It is evident from (2) that since $\mathrm{M}k^2$ has no effect on the condition (3,) the mass and form of the moving parts have no influence on the results here aimed at, which are affected only by the relative dimensions of the different parts of the engine. It is plain also that the result may be obtained in a great many different ways. Thus, let the pressure (P) at the beginning of the stroke be given, R the resistance, (a) the half length of the beam, and also (c), then by giving to either (α) the semi-arc of vibration, or to (s) the space before the steam is cut off their values, so as to satisfy equation (3), we can insure that there shall be no sudden jerks and wasteful expenditure of the moving force at the points of alteration in the motion. Similarly, if a and s be given quantities, we may choose amongst (a), (c), &c., what lengths and proportions to give. In making a practical use of the formula (3), it must be remembered that the logarithms there used are the Napierian, and therefore must be multiplied by $\frac{1}{\log_\varepsilon 10}$, or by ·434 nearly, to convert them into common logs., and the formula may be written thus:

$$(\mathrm{P}-\mathrm{R}).\ a\ (\sin\alpha - \sin\theta') + \mathrm{R}.\ a\ (\sin\theta' + \sin\alpha)$$
$$= \mathrm{P}s.\ \log_{10}\left\{\frac{d-c+a\sin\alpha}{d-c-a\sin\theta'}\right\} \times 2.3025$$

Log_{10} denoting the common logarithms.

A. H.

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NAPIER'S PATENT IMPROVEMENTS IN SMELTING COPPER ORES.

[Patentee, James Napier, of Shacklewell, Operative Chemist. Patent dated January 20, 1846.]

The patentee states that the object of his invention is to facilitate the smelting of copper ores, and that it consists in the application of iron and alkaline substances, and also in treating the products with water, in order to decompose and disintegrate them. When he has to operate on ores containing less than 20 per cent. of copper, and more than two parts of sulphur to four parts of copper by weight, he proceeds to calcine such ores after the ordinary method; and when this operation is completed, he removes them to a smelting furnace, in which they are submitted to the usual smelting process, the product of which is technically known as "coarse metal."

When he has to operate on ores which contain less than 20 per cent. of copper, and a smaller proportion than one part of sulphur to four parts of copper by weight, he adds a quantity of copper ore —containing more than two of sulphur to four of copper—so as to make the relative proportion in the whole mass of sulphur to copper two to four, and proceeds as above to obtain the "coarse metal."

When he has to operate on ores containing by themselves, or when mixed with other ores, more than one part of sulphur to four of copper by weight, and also more than 20 per cent. of copper, he omits the calcining process, but adopts the same smelting operation as in the two preceding cases to obtain the "coarse metal."

The subsequent operations are as follow: With every ton weight of "coarse metal" is mixed 56 lbs. of soda ash (containing 50 per cent. of alkali) and 56 lbs. of slaked lime. The whole is placed in a smelting furnace; and when well fused, 100 lbs. of scrap iron is thrown in—sprinkled over the surface— and well stirred in with a rubble. The melted metal is then run out into sand moulds, or into water, and, when sufficiently set, is removed to shallow pits, containing enough water to just cover the mass, wherein it remains for from two to four hours, for the purpose of being partially decomposed and disintegrated. The water is now run out, and the metal left in a moist state for 24 hours, at the expiration of which time it is reduced to a powder. He next proceeds to cleanse this powder in the following manner, which he states he has found to be successful. In a wooden box with a double perforated bottom, having interposed between the board a wire gauze, of about 25 to 35 meshes to the square inch, is placed the powder, and the box is placed in a tap-pit, with a vent below the level of the bottom of the box. Over the vent is fastened a piece of gauze, having from 60 to 70 meshes to the square inch.

The box is filled with water and the vent opened, and this operation is repeated twice. The mass is then transferred to a calcining furnace, and begins to heat it gradually, so that at the end of 20 hours it assumes a yellow heat, which he maintains for six hours longer, taking care to stir the metal well to prevent it from caking or fusing. The powder is drawn, sprinkled with water, and removed to a fusing furnace, and to every ton of powder 100 lbs. of anthracite coal, in powder, is thrown in, together with 10 lbs. of sand; and if the metal be found difficult to fuse, lime and fluor spar, as a flux, is added. When the whole is perfectly melted, it is run out into sand moulds, and is fit for refining, which last operation he performs in the usual manner.

The patentee desires it may be distinctly understood that he does not confine himself to any of the above specified details or proportions, which may be varied according to circumstances; but what he claims, is the application of iron and alkaline substances to facilitate the smelting of copper ores, and the treating of the products with water to decompose and disintegrate them.

INVENTORS AND INVENTIONS.

[*Translated from "La Presse" for the "Mechanics' Magazine."*]

There is under this double title the indication of an order of ideas peculiar to a class of men, little inquired after, little studied, and, in consequence, but little understood. It is well known what is thought and said of inventors and their inventions, when people are condescending enough to concern themselves about them. When the Institute has mentioned the name of an inventor, or the

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Society for the Encouragement of Arts and Sciences has inserted in its bulletins some favourable report of an invention, there is then an end; the inventor and invention drop alike into obscurity and oblivion. Sometimes, to be sure, one may discover in the advertising columns of a newspaper that an inventor has had the good fortune to find favour in the eyes of some monied man, who has secured to himself the working of it out by the temporary guarantee of a brevet. But with this exception, neither the invention nor the inventor ever come to light again.

In these days, when practical science is incontestably making great progress, why do not some of our learned men, on whom fortune and renown have conferred the requisite leisure, endeavour to ascertain what becomes ultimately of all these inventions, so numerous, so dearly paid for to the State, and nevertheless, so greatly neglected? The inquiry would be as honourable as its utility is unquestionable. It may be well that our early annals should have their explorers—that even the ruins of Nineveh and Palmyra should have their excavators—that we should send missions for special scientific purposes to all parts of the world; but would it be less proper to institute also an inquiry into the ultimate fate of the multitude of ingenious men who have left traces of their patriotic labours on the registers of the Treasury?

The result of such an inquiry, if ably conducted, would furnish a profitable lesson to the economist, the statesman, the manufacturer, and even to the future inventor. It might have the effect also of persuading the Government to revise the existing "Law of Brevets," which has equally disappointed the expectations of those by whom it was framed, and of those for whose benefit it was designed.

But such an inquiry would require study, and much of it; and how few are the charms which it offers to minds ambitious of literary distinction! How few would care to avow that their labours had nothing more important for their object than to trace how it ordinarily fares with the man who is lauded to-day in the halls of the Institute for adding by his genius to the productive resources of his country—who perchance has paid, and still continues to pay, the State for an invention, of which the State alone reaps all the benefit! One man, indeed, there is who has been bold enough to do this—every one is acquainted with the resigned and suffering physiognomy of that type of the inventor-class to whom the author of *La Comédie Humaine* has given the name of *David Sechard.* Let us express, however, by the way, our regret that M. Balzac has not developed more thoroughly the genius of invention—a subject so congenial to his character and his talents.

It seems evident that "something" ought to be done for inventors and their inventions. But this task we certainly will not take upon ourselves to perform, and for two reasons—first, because it is a labour that would require all the leisure of some author retired from active life: and, second, because we do not wish to abuse the kindness of the *Presse* in granting a portion of its columns to a *compte rendu* of inventions, by converting it into a martyrology of modern inventors.

Nevertheless, it is but justice to state that the inventors of the present day reap the benefit of the general amelioration which our manners and our laws have of late years experienced. If they will but look back on the past, they cannot deny that their situation is superior to that of their predecessors. They are allowed not only to take, but even to engross (with the all-powerful help of money) the title of inventor. They need not dread the hemlock of Socrates, the prison of Galileo, the exile of Descartes, the fate of Papin, or of Fulton, or of Jacquard, and so many like them, who might be mentioned. Yet, nevertheless, there is evidently a change for the better; though they may not have to fear the violent persecutions of former days—seeing that now no one is persecuted—still they are far from being able to reckon upon the protection of any one. If impelled by the influence of their genius, they exceed the limits of their own pockets, they are made to atone for their folly by the sacrifice of their liberty. Witness M. De Riders, and M. Sauvage, who have just come out of a jail. How few are there who remember what M. De Riders has done for the railways? It would not surprise us if his name were unknown even to the stockbrokers themselves.

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So it is, the inventors of our days have as little to fear from absurd persecution as to hope for enlightened encouragement. They enjoy their discoveries as they enjoy a sunny day, without reference to the source of the light and heat by which they are animated.

From the haughty noble down to the humble workman, from the rich manufacturer down to the petty shopkeeper, there are few to be found just enough to thank the inventor for the advantages which they owe to him, for the means which he affords to them of employing most profitably their strength, their time, or their money! The seaman believes that the wheel and the screw date from the Phœnicians; the gilder never supposes that he owes any debt of gratitude for the art of gilding without the employment of quicksilver. The merchant who performs in a few hours what was but lately considered a very long journey, and hence trebles his profits, will not even bestow a passing thought on the man who first created the present wonderful system of locomotion!

Interrogate the thousands of workmen in our factories and workshops, who have now no longer to expend their muscular strength in labours which assimilated them to beasts of burden; who have now but to furnish the intelligence necessary to make machines furnish every description and amount of mechanical force — yes, interrogate these workmen while standing by, with folded arms, gazing on the operations of some powerful engine, and you will, in all probability, find them ignorant even of the name of the inventor!

Nor is this indifference, this obliviousness, peculiar to the common people; for it extends equally in the higher classes of society, and even to the Government.

Certainly, the country has reason to be proud of the progress of its manufactures. It seems unaccountable, therefore, that in our national exhibitions, that in the system of our legislation, that in the recompenses which the State bestows on merit, the claims of the inventor are so little attended to. No one can deny that the manufacturer is richly deserving of national rewards; but there is a claim superior to that of the manufacturer and of the capitalist—it is that of the inventor—whose interests, whose rights should be objects of first consideration, and whom it should be the duty of Government to bring forward, even though he should endeavour to withdraw himself from public gaze.

The indifference of the public with respect to the inventor is palpable in the law which regulates brevets of inventions. Notwithstanding a most learned discussion, conducted with the best intentions in the world, our statesmen have omitted in this law much which is important and necessary. In framing it the Government seems only to have thought of organizing a system easy of application, while the legislature appears to have acted on the principle of taking everything for granted, without examination. And thus it has happened that the interests of the inventor have neither been sufficiently investigated nor protected, as we shall endeavour hereafter to prove.

And yet these interests ought to have been of primary consideration — for surely invention is the primary cause of all progress in manufactures. It is evident (as M. Jobard, of Brussels, observes) that there can be no manufactures where there are no inventors. Our national industry only dates from 1791, when our inventors first obtained legal guarantees and protection. In Italy, in Spain, in Turkey, there is *trade* but no *manufactures*, simply because there are no inventors.

We will say even more: were the spirit of invention to pass away from the land, our national industry would immediately feel the effects, our national manufactures would be paralyzed, and France would descend to the level of those nations who scarcely attempt to attain the rank of manufacturing countries.

In France everything seems to act in concert to discourage inventors; they suffer from the neglect of the public, the omissions of the laws, the indifference of men of capital, who despise every investment but those of the Exchange. We are verging slowly towards a similar result to that produced by the Edict of Nantes. In France brevets are taken out, because, at all events, if they lead to nothing, they do not cost much. This is why it happens that many inventors consider it only a useful formality to apply for a brevet in France, on obtaining which they immediately go over to Eng-

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land, where they expect to find capital, honour, and profit.

Fortunately, there is one obstacle which hinders our inventors from availing themselves, *en masse*, of the hospitality of Great Britain. The English legislature, graver than ours, has placed all kinds of formalities, of difficulties, and of expense, between a patent and the applicant; and the last reason, namely, expense, deters many of our inventors from emigrating to England. A patent costs nearly 10,000 francs (400*l.*) for the whole of the United Kingdom. And if we add to this sum the expense of a voyage, and a residence in England, (invariably a dear country to sojourn in,) one can easily understand what a great obstacle this must prove to those who wish to carry out in England inventions breveted in this country.

Let us admit for the sake of argument that our inventors might find in the English law the same facility that they enjoy in our own, what would be the result? Firstly, our inventions would pass over to our neighbours, and vivify their national industry; next, France, owing to her Custom-house tariff, would be unable to profit by the discoveries of her own citizens. We are already but too much tributary to the English manufactures—it is time to free ourselves from the yoke—and the first step we should take in order to attain this desirable result, would be to examine seriously the claims and interests of our inventors.

But here we must answer the objections made to this serious inquiry. We are told that there are *so* "many bad inventors and worthless inventions." Mr. Jobard replies thus to this accusation: "People are so apt to say that there are so many *bad* inventors and *bad* inventions, without considering that there are as many *bad* writers, *bad* painters and *bad* poets; as many *bad* herbs, *bad* fruits, and *bad* hearts, and the proof of this, nay, almost the cause, is that there are so many *good.*" It is truly incredible that it should still be necessary to prove the necessity of protecting inventions, and that our statesmen, our political economists, our journalists, do not yet understand the important part which the inventors have to play on the stage of the world—a part which they have not yet defined nor analyzed—a part which they do not yet entirely understand.

Deny it who may, invention is the primary source, the soul of all progress in manufactures, and of all civilization; and it is to the national spirit of invention that France owes the ascendancy which she holds amongst the nations of the world as regards all articles of which taste is an essential element. Other nations may rival France in the productions of the soil, and in coarse staples, such as wool, iron, &c.; but whenever taste is brought into question, the superiority of this country is undeniable. And yet how ungratefully and disdainfully does this same country act towards those of her children to whose genius she is thus indebted! Such a state of things is most improper and unjust; but for this reason, if for no other, it is a state of things that cannot last. The *Presse* has been the first to lend its columns to those who would uphold the cause of inventive genius, and this is already a great step towards improvement. It is not the first time that this paper has exercised its influence in favour of proper reforms before any other. Let us hope that a like feeling of justice and benevolence may awake elsewhere the same sympathies in favour of inventors, and may actuate others to join it in the endeavour to protect the spirit of invention, which is, beyond all doubt, the most striking characteristic of French genius.

Gardissal,
Ingénieur Civil, Membre de la Société d'Encouragement, de la Société Industrielle de Mulhausen, Directeur du Journal *Le Brevêt d'Invention.*

MANURES.

Sir,—Farming people take in general little or no pains to store fecal matters, because they meet with great difficulty and repugnance in making use of them. Were it otherwise, there is little doubt of such matters being used and turned to good account. The following plan, which I extract from a recent number of a French journal, will be found efficient for depriving them of their offensive odour, and at the same time for reducing them to a state fit for manipulation:

Let a ditch or well be made, and pave

it with tiles joined together by hydraulic cement, so that the urine may not be lost. Dissolve a little sulphate of iron in warm water, and allow it to cool; then add to it four or five handfuls of lime, as much coal in powder, and a small quantity of soot, and throw the whole into the disinfecting ditch or trough. Five or six pounds of sulphate of iron are sufficient to operate upon twenty-five gallons of matter. The decomposition of the matters is prevented, and they are at the same time rendered more valuable for manure. When the trough has to be emptied, it is uncovered, and is to be again watered with the above mixture. As much burnt earth is then mixed with its contents as will render them as easily divisible and as easy of handling as cinders or ashes. The substance is thus prepared ready for immediate use. No odour whatever exhales from it, neither is it offensive to the sight.

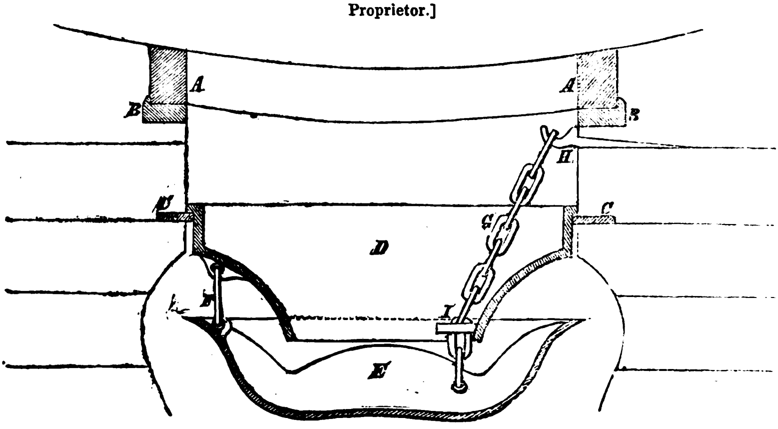
The same mixture might with advantage be applied to the troughs destined to receive the urine of animals, as also to those pools of liquid which filter from dung heaps, to the emanations from which may be attributed much disease in country villages.

I am, Sir, yours, &c.,

A FARMER.

WALKER'S HANGING AIR-TRAP.

[Registered under the Act for the Protection of Articles of Utility. Mr. John Walker, Inventor and Proprietor.]



Few, if any, of our town readers, can have failed to have personally experienced inconvenience and annoyance from the open state of the metropolitan drains. London, with its thousands of miles of sewers, must ever be far from that sanatory condition to which her citizens and the legislature are anxious to elevate her, if this nuisance continue unabated; and of little avail will be the Thames' embankment for the conveyance of the soil to a distance, if it be previously allowed to flow under the great thoroughfares of our town, sending up at every (open) grating noxious vapours to pollute the air and breed a pestilence among us.

Another disadvantage of the present open grating is, the facility it affords for the passage of stones and other hard substances down into the body of the sewers. Any invention, therefore, which will effect the twofold purpose of obviating these evils, and combine cheapness of construction with simplicity in detail, so that it may be easily adapted to the sewers, as at present built, and as easily cleansed when occasion requires, must doubtless receive the favourable attention and support of the public.

To this task has Mr. Walker addressed himself, and, in our judgment, most successfully. The following is his own description of his invention:

The above drawing represents a sectional elevation of the trap. A A is a common grating, and B B the frame on which it rests; C C is another frame, supporting the air-trap, of which D is

the upper, and E the lower portion. The former is either bedded upon the ledges C C, or in the brickwork, so as to make it air tight at that place—while the latter is suspended from D by two links, F, (only one being seen in the drawing,) which serve the purpose of a ling. The opposite side is supported by the chain G in such a position that it shall always present a "seal" of water against the exhalation of gases or vapours from the drain, and at the same time prevent the descent of any stones or other hard substances.

When the basin of the trap requires cleansing, the upper link of the chain is unhooked from the pin H, and the basin falls down at that side, to be the more readily emptied. The chain is prevented falling out of reach by the ring I.

MR. ALEXANDER GORDON'S FUMIFIC PROPELLER.

In our journal of 25th October, 1845, we gave a full account, illustrated by engravings, of a new mode of propelling vessels patented by Mr. Alex. Gordon, to which he has given the name of "Fumific Propulsion." The inventor has since subjected his theoretical conceptions to the test of actual experiment, and has published the "Results" in a pamphlet, from which we make the following extracts. Mr. Gordon complains, with apparently good reason, of the prejudices which he has had to encounter on the part of "steam-engine men." Let us hope that his plans may yet have that fair and unbiassed consideration to which assuredly they are well entitled.

From time to time the law of the specific heats of water and of air, which is so decidedly in favour of the latter, has led men of high mechanical attainments to venture from what may be called the steam-channel, and to attempt the formation of a prime mover, by bringing the improvements of the steam engine to subserve the application of air heated by transmission, or the application of the products immediately obtained from combustion, and thus to actuate some modification or imitation of the steam engine. They took the steam engine as their prototype; I take the rocket as mine. They differed from their pattern by changing the elastic medium only; I differ from my pattern by changing the supply of the support for combustion, and of the application of the power when generated. The particulars are described in the specification of my patent, of date 3rd March, 1845; also in the *Mechanics' Magazine*, October 1845, and in "A Description of the Fumific Impeller," which was published by Dalton.

It is only necessary to say here, that machinery, whatever may be its beauty, cannot add to the power of heat as the prime mover. On the contrary, it always wastes part of the power by non-appropriation, friction, radiation, and leakage.

The power of a steam engine is obviously more in the steam pipe which conveys the steam from the boiler to the engine, than in the engine; and it is more in the furnace than anywhere else. It is really in the chemical action of combustion in the furnace, but we find the only available part of it in the steam pipe; the engine, machinery, and paddles of a steam vessel being nothing more than the arrangement necessary in applying steam to operate indirectly upon the water, and thus to impel the ship in her desired course. In using steam, we must operate indirectly upon the water, because all attempts made for applying the rush of steam along the steam pipe, under and directly upon water in the manner of a rocket, have failed, by reason of the condensation of that steam whenever it comes into contact with the water upon which its power was wished to act.

It is of the utmost importance to the right understanding of this paper, that these facts be kept in mind.

In a steam-ship making a passage across the North Atlantic Ocean, the power of heat used for impelling her, are the currents of steam of a certain pressure rushing along the two main steam pipes from the boilers, which, multiplied into the sum of the areas of these pipes, and by the pressure (adding the value of the vacuum), constitute and express the power of heat which impels her. These currents of power are in constant flow, and correspond in their velocity to the ship's rate of going.

We have just seen that these streams of steam power are not disposable for use by directing them at once against the sea. We shall now observe that, *what cannot be done by steam, can be done by hot air, or by the hot products of combustion;* currents of which may be discharged at once under water backward to impel the vessel forward, or forward when the vessel is to be impelled backward. These currents being permanently elastic, do not collapse as steam does; and, being tenacious of their heat, the necessary impact can be had to move the ship in her required course.

The Congreve rocket is impelled without any machinery, and without steam. The impelling composition consisting of combustibles and a supporter of combustion,

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selected, proportioned, and intimately mixed for augmenting volume by a fresh arrangement of particles, and for producing the aëriform fluid at a high temperature. There is a mass of this intimate mixture within the case, which, independent of any oxygen from the atmosphere, forms, in a few seconds, a *fumific impulse*, which discharges itself through the "throat" of the rocket.

The composition produces 500 times its bulk of gas at the mean temperature of the air, whilst its elastic force is increased by the heat to not less than 2000.

One of the largest rockets now used in the English service, either for bombardment or field-work, is called a 32-pounder Congreve rocket. The entire weight, with composition, clay, iron, stick, and the gunpowder for bursting the cast-iron head at the end of the range, is 33 lbs. The length of the head and case is 2 feet, the external diameter $3\frac{7}{10}$ inches. The rocket-composition occupies an interior cylindrical space of $3\frac{1}{2}$ inches diameter, × 21 inches long; and this composition weighs 10 lbs.

The combustion of this 10 lbs. of composition, and its rush *à tergo*, projects the rocket over a base line of 3450 yards (or only 70 yards short of *two miles*) *in seven seconds*. Here, then, is an instance of much higher velocity than that of any machinery or implement, not even excepting a cannon ball.

We need not discuss here the rocket's flight. The fact of its flight in the air, and of its passage through water, and even through loose sand, is enough for my purpose of showing the direct action or reaction of the hot products of combustion for navigation.

Having constructed a small model-boat, with a brass rocket-case in the keel, I made a course of rocket experiments with different compositions. The result of several experiments may be stated as follows:—The model-boat displaced 15 lbs. weight of water, and a common 1 ounce rocket, inflamed under water, impelled this boat 30 feet in 4 seconds, or at a rate rather over 5 miles per hour.

In all of these small experiments a perfect impact was obtained on the instant of inflammation, and so great was this, which may be called the initial velocity, that the small vessel skimmed the surface with less draught of water than she had when at rest.

Being thus satisfied that, if I could economically apply a continuous stream or streams of hot products of combustion of requisite pressure, and at a velocity little above the speed required of the ship, I should probably supersede the steam engine for purposes of navigation, I proceeded with the following experiment:

The approval of some friends, and also of some who to me were strangers, was encouraging. These were gentleman of high chemical and philosophical attainments. Among the latter was Captain Sir Thomas Hastings, R.N., whose extensive and intimate knowledge of what is now done and may be done in gunnery and rocket practice, particularly fitted him to express an opinion upon the proposition; and I must not omit the name of Professor Baden Powell, of Oxford.

To these two gentlemen in particular I am much indebted for the unasked and unexpected encouragement they have given me in a matter where engineers have been unconcerned, or unable to appreciate the invention, or unwilling to be troubled in the matter.

The difficulty I have had in convincing any steam-engine men has been very great. They bring everything to that *machine* as the standard of excellence, and seem (with very few exceptions) to disbelieve, practically, that heat is the source of power in the machine which they idolize, and that the same heat is available, independent of water, steam, and the numerous elegant contrivances and appliances which are rendered necessary for using the tender and easily condensed stream.

Those engineers and steamboat parties who could believe in the possibility of obtaining power by the hot products of combustion, directly applied as I proposed, could not see how a sufficient impact could be obtained to impel the boat in her course with sufficient economy. Therefore I determined to demonstrate the fact at once by an experiment on a sufficiently large scale.

The experiments of Mr. Ericcson,* of Mr. Robert Stein,† of Mr. Sterling,‡ and of Sir George Cayley,§ showed how the continuous production or presentation of hot air could be relied upon.

The proposers of hot air engines have taken the steam-engine, subsequent to the discoveries of Newcomen, as their model, whilst they should have reverted at once to the engines of Savery and of Papin. They should be referred to the Marquis of Worcester's scantlings, and even to the smoke-jack of Hieronymus Cardan.

The Marquis of Worcester employed the pressure of steam to act at once and directly upon the water which he desired to put into motion. Savery, also, used steam in direct connection with the water. Dennis Papin improved on these by interposing a loose

* Recorded in the Institution of Civil Engineers.
† See "Repertory of Arts," 1821.
‡ "Transactions of the Institution of Civil Engineers," 1846.
§ Idem.

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floating piston between the steam and the water to be moved.

Now, had any one of these latter used, instead of steam, the hot products of combustion from a close furnace, the steam-engine would not now be the only available inanimate artificial power in use for such purposes as raising water, and for navigation.

The streams of hot products of combustion from Sir George Cayley's close furnaces to his engine cylinders were as regular and as powerful as the stream of steam along any main steam-pipe.

All previous attempts to make hot-air engines have been by following the form of the steam-engine. I attempted to make close furnaces imitate a rocket, and the following will show with what success:

Into a boat, 26 feet long and 4½ broad, I fitted a close furnace, or retort, and a common small forge bellows. The close furnace being opened at top and at bottom, an intense fire was got up; the bonnets at top and at bottom were then luted and fitted tight. The upper or reservoir portion of the bellows was not used. Each stroke of the lower portion of the bellows passed air through the close fire for the hot products of combustion to rush out against the water.

The boat, when tried with this apparatus, weighed in all 4,375lbs.; in other words, that weight of water was displaced by her flotation when the discharge-pipe was immersed 12 inches.

Each stroke of the portable forge-bellows sent cold air into the close furnace. The appropriation of oxygen to support combustion was *instantaneous;* and the heating of all the aëriform body which passed off by the discharge-pipe was also *instantaneous.* The products of combustion, almost altogether aëriform, but also occasionally mixed with smoke, dust, and ashes, rushed out (at a temperature of 800° or 900°) by the discharge-pipe, which was three inches in diameter.

Not to be tedious; a narration of mistakes and disappointments may be avoided, and the action or *re*-action of the arrangements, shown on the drawing, explained.

A valve being, of course, in the cold-air pipe, between the bellows and the furnace (and, as has been said, the upper chamber of the bellows inoperative,) I sent a succession of blasts into the bottom of the furnace, and, consequently, up through the intense fire, to find its way out under water by the discharge-pipe.

The first blast, by one man, always started the boat (weighing nearly two tons) from a state of rest three feet in two seconds; and I believe that no two men, with oars or sculls, with all the advantage of their flexor and extensor muscles, could do more. And neither paddle-wheels nor the Archimedian screw can start the same weight into such motion in the same time.

I several times repeated these experiments upon what may be called the initial velocity had by the first blast, or jet, or shot.

The leaky and sinking condition of the old boat, broken and out of shape by liftings by a crane, prevented my continuing the course of experiments so far as to be able to take her rate, consumption of fuel, and the line-haulage power necessary for the same rate. These latter points will be more fully illustrated when I shall have fitted a larger vessel with several close furnaces, and with blowers either actuated by a steam-engine, or kept in motion by part of the power of the vessel's own velocity through the water.

Enough has, however, been done to show the value of the discharge proposed. There are several chemical means for increasing the power and rapidity of the currents, for starting suddenly, or for increasing the ship's rate in cases of emergency.

A succession of such discharges will give the required accelerated velocity, and the shipwright can arrange to have them in the bilges, after-body, or other parts of a ship, so that one or more discharge-pipes may deliver their power backward to send the ship a-head; or forward to send her astern; or backward on one side, and forward on the other side; to bring the ship about, or direct her head to any given point.

The fire, and one man blowing air, has, we have seen above, done the work of two men. From which it follows, that suitable close furnaces, blown by a 50-horses-power steam-engine, will do the work of 100 horses in impelling the vessel; and so on in proportion.

Even let a sceptical reader doubt my accuracy as to the one man's power being, with the fire, equal to two men's power in rowing,—let him even insist that one man with oars could do as much as this man did with the products of combustion, such a reader cannot reasonably deny that shipshape vessels can be impelled, without smoke, chimneys, paddles, or screws, by the mere discharge of the hot products of combustion, whilst the blowing is effected by a steam-engine, which may be worked from a boiler or boilers, which may be made to surround and embrace the close furnaces.

I may now anticipate the possibility of expression of any doubt upon the economy and safety of impelling vessels by the direct application of the hot products of combustion.

The economy will be greater than in the

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steam-engine for several reasons:—Because the expansion of a gaseous body by heat is greater than that of steam: Because 1lb. of fuel will raise $7\frac{8}{10}$lbs. of water 1212°, or 19lbs. of water 480°; and 1lb. of the same fuel raises 29lb. of air 1212°, or 74lbs. of air 480°: Because the steam-engine does not and cannot use all the heat generated in the furnaces; 500° pass off at the top of the steam-boat chimney,* and what heat the engine can use has to overcome the friction, the drag of the air-pump, the feeds, waste water, &c.; whilst by using the hot products of combustion, as shown in this paper, all the heat of the furnaces is applied; there is little friction but that of the air-pumps or blowers, and only half the power obtained in the furnace is required to work the blowers. Another feature in the proposed mode of impulsion is that, whilst the working economy of a steam-engine depends upon slow combustion in the furnaces, and an uniform and limited speed of the machinery, the working economy of the proposed system is rather promoted by rapidity of combustion, and is capable of being worked slowly by gentle currents, or jets, or puffs; or fast by roaring blasts, there being no machinery which can be injured.

The safety of the proposed impulse is not affected by a store of power in many tons of boiling water ready to burst into steam; it may be injured by there being no store of power whatever.

Perhaps this mode of impelling bodies is the nearest approach to the variable intensities of animal power, where the combinations of oxygen and carbon are more slow or more rapid as the same size of lungs may require it to be for slow motion or for the fleetest course of the animal.

THE RIVAL ELECTRIC TELEGRAPHS.

Court of Chancery.—Feb. 24.

The Electric Telegraph Company v. *Nott and others.*

This was an appeal from an order of the Vice-Chancellor of England refusing an injunction applied for by the plaintiff, (see *Mech. Mag.*, 1846.)

It will be recollected that the plaintiffs' patent was obtained as early as the year 1837, and was granted in respect of an apparatus for transmitting electricity so as to convey signals and sound alarms between distant places. This invention, better known as the Electric Telegraph, has been adopted with success on many lines of railway, and has, of course, hitherto, been a source of great profit to the Electric Telegraph Company. In the early part of the last year the defendants also obtained a patent for the same purpose as the plaintiffs, which they allege is different in principle to the plaintiffs' patent; and among the various differences set forth is the important one that their machinery is capable of being worked by one wire instead of five, as has hitherto been the case with the plaintiffs' patent. This last-named improvement, with others, lessens the expense of constructing the telegraph by 100*l*, a mile, and will, if the defendants' patent prevails, most seriously interfere with the monopoly heretofore enjoyed by the plaintiffs. The suit was, therefore, instituted for the purpose of obtaining an injunction to restrain the alleged infringement of the plaintiffs' patent by the defendants, and a vast number of affidavits of scientific men were filed on the parts respectively of the plaintiffs or defendants. The Vice-Chancellor refused the injunction, and from that decision the plaintiffs appealed.

The Lord Chancellor this day delivered judgment, and said that the great importance of the stake at issue between the parties, and the interesting nature of the case, had alone induced him to pause before giving his judgment; for, notwithstanding the great length to which the discussion had run, and the learning brought to bear upon it, when the facts of the case were applied to the well-known rule which governed the Court in dealing with cases of this description, there was no difficulty whatever in the matter. He had frequently had occasion to express his opinion as to the course which the Court ought to adopt when application was made to its extraordinary jurisdiction in support of a legal right. He had said before, and he would say then, that if there were any doubt whatever respecting the validity of the legal right, the Court ought to be extremely cautious in exercising its power of interfering by injunction. There were two reasons why this power of the Court ought not to be lightly put in motion—the first was, that if it should turn out that the applicants' legal title should fail, the Court would have interfered without any necessity; and the second and principal reason was, that there was no comparison in the mischief which might result in the granting and withholding the injunction; the measure of injury which the plaintiff might sustain from the non-interference of the Court could not be equal to that which the defendant might suffer from the granting of an injunction

* Paper in the Institution of Civil Engineers, by Andrew Murray, Esq., Chief Engineer of Portsmouth Dockyard.

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which could not afterwards be sustained; the more so as in the one case the damage done might be ascertained and recovered, but not so in the other. It had been said that he (the Lord Chancellor) had carried this principle too far, but on referring to the case of "Hill *v.* Thompson," which had been cited during the argument for a particular purpose, he found that he by no means went so far as Lord Eldon had done in that case; for there the learned Judge had stated that he would not trust his judgment to pronounce an opinion as to the validity of a patent by granting an injunction where such patent was a new one, which was carrying the principle much further than he had ever done. The rule, however, that the Court should be cautious in restraining a defendant where it was not quite clear that the plaintiff had legal title was subject to this exception—that if the patent of the plaintiff had been in existence for a lengthened period of time, it ought to be presumed that he had a legal title against all the world until such patent were proved to be invalid; and under such circumstances he was entitled to the protection of this Court. There was quite sufficient, however, in the present case for the purpose of deciding it without entering into the question of the plaintiffs' legal title. It might even be assumed, for argument's sake, that their legal right was made out, and then they would be in the same situation as other persons possessing legal rights, such as parties entitled to copyrights. That being the case, the only question to be ascertained was whether the other party had violated such right; looking in this case at the affidavits which had been made by a number of scientific gentlemen on both sides, it would be a rash course indeed in him (the Lord Chancellor) to come to the conclusion that there had been a violation of the plaintiffs' patent, when the contrary was sworn to by some of perhaps the most eminent men in Europe; the question, therefore, was not so free from doubt as to justify him in deciding upon a matter of so technical a nature as the present, when some of these scientific gentlemen distinctly alleged that, although the same materials in the defendants' patent were applied to a similar purpose as in that of the plaintiffs', still the mode of application was new. Although his opinion, if given, might not affect the case one way or the other, still in the face of the conflicting affidavits of these eminent men, he must say that it was not a case so free from doubt as to warrant this Court in exercising its extraordinary jurisdiction by injunction. He might have great difficulty in forming an opinion upon the case, were it necessary; but it was not so, as the whole matter must rest upon the affidavits; and therefore, without expressing any judgment upon the merits, he (the Lord Chancellor) thought the case was brought within the principle of the Court which he had before alluded to, respecting its hesitation in interfering in matters of doubt, before the legal rights had been defined. The view, therefore, taken by the Vice-Chancellor was the right one, and the plaintiffs had no grounds for coming to this Court until they had established their title at law.

Judgment of the Court below affirmed, with costs.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 190.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

Joseph Jacob, of the parish of St. Ann, Soho, (Middlesex,) coachmaker: specification of an invention of a new metal box for the axletrees of wheel carriages, mills, engines, and other machines. Jan. 20, 43 Geo. 3; Jan. 26, 1803.

James Gayleard, of New Bond-street, in the parish of St. George, Hanover-square, (Middlesex,) stay and habit maker: specification of an invention of long stays, short stays, and corsets, on an improved construction, either elastic or otherwise, for the use of ladies. Feb. 2, 43 Geo. 3; March 2, 1803.

Samuel Miller, of the parish of Saint Pancras, (Middlesex,) engineer: specification of an improved method of applying the repelling or repulsive force of nature in order to give a stronger impulse to any substance or body in motion, as well as to destroy the bad effects of its baneful activity. March 16, 43 Geo. 3; April 15, 1803.

Richard Francis Hawkins, of Woolwich, (Kent:) specification of a method of applying a certain power to the working of ship and other windlasses, ship and other winches, cranes, and other purposes, and to which the same hath never before been applied. [An endless screw turned by a winch handle, working a cogged wheel.] April 5, 43 Geo. 3; April 23, 1803.

Walter Beaumont, of South Crossland, near Huddersfield, (York,) manufacturer of woollen goods: specification of an invention or discovery of a certain mixture to be used

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in the preparation of sheep or lamb's wool for various purposes, (*i. e.*, instead of oil in the manufacture of woollen cloths, &c.,) by which a considerable saving will be made in the article of oil. May 17, 43 Geo. 3; May 21, 1803.

Edward Shorter, of New Crane, Wapping, (Middlesex,) mechanic: specification of an improved apparatus for working of pumps in ships. [By means of a wheel set in motion by the water, &c.] March 21, 43 Geo. 3; May 21, 1803.

Marc Isambard Brunel, of Queen's-square Place, Westminster, (Middlesex,) gent.: specification of an invention of new trimmings and borders of muslin, lawn, and cambric, for articles of dress or furniture. Nov. 25, 43 Geo. 3; May 25, 1803.

Joshua Green, of Banbury, (Oxford,) shag and plush manufacturer: specification of a method of manufacturing of corded and ribbed shags and plushes composed of different materials, on a principle entirely new, called (by the specifier) "The Banbury New Cord." May 17, 43 Geo. 3; June 13, 1803.

Robert Mason, of St. Thomas-street, Portsmouth, (Southampton,) and late of Cumberland-street, Portsea, gent.: specification of certain improvements on a common waggon, whereby the same may occasionally be separated and used as two carts, which is denominated "The Patent Hampshire Waggon." Feb. 28, 43 Geo. 3; June 16, 43 Geo. 3, 1803.

Chester Gould, of Red Lion-street, Clerkenwell, (Middlesex,) gent.: specification of an invention of a glass on a new principle, to be used by mariners at sea, instead of the common sand glasses, when heaving the log, for the purpose of ascertaining the ship's rate of sailing, and also for other uses on land and at sea. May 28, 43 Geo. 3; June 27, 1803.

James Fussell, of Mells, (Somerset,) iron manufacturer: specification of improved methods of working of water wheels, raising of water, and in a great measure preventing water wheels from being flooded, and other useful purposes. June 14, 43 Geo. 3, 1803; August 11, 43 Geo. 3, 1803.

Michael Logan, of Paradise-street, in the parish of St. Mary, Rotherhithe, (Surrey,) engineer: specification of a new invented conservative lock, for continuing inland and canal navigation with a given quantity of water, that is, for preserving the whole quantity of water which at present is expended in the passage, or passing, of all boats, vessels, or craft, through the locks, established in any line of inland or canal navigation, and for raising great bodies or quantities of water to any assigned altitude, for the purpose of supplying extensive levels in canals, and for filling reservoirs of great capacity, constructed upon superior or higher levels, by which the gravitating power or force of descending columns, or sheets of water, can at any given altitude be obtained, and continued for the use of water works, mill works, manufactories, or systems of machinery of any description, wanting the power or gravitating force of water for their motion, or operations. August 6, 43 Geo. 3; Sept. 6, 1803.

Durs Egg, of the parish of St. Martin-in-the Fields, within the liberty of Westminster, gun-maker: specification of "Certain improvements upon fire-arms and their locks," consisting of improvements upon locks—a new method or priming, by which one cannot put too much powder, or too little—an improved pan and hammer to expel the damp and water—a new way to load all sorts of fire-arms at the breech—a new nipper or shear, to cut the cartridge for priming—an improved way of priming from the inside of the barrel, when charging through the touchhole—fire-arms constructed for the barrel to slide in the stock by the pressure of recoil, to give with a spring to shoot truer, and diminish the kicking—an improved sight at the breech—an improved stock to pistols, with a support on the upper part of the stock, or grip, as a stop against the hand, to prevent the pistol moving when fired, also a support to rest against the arm or shoulder—also a new constructed pistol for firing off cannons, and an improved cock and side nail, to prevent accidents by the turnscrew slipping out—and an improved worm for ramrods. March 23, 43 Geo. 3; Sept. 23, 1803.

Chester Gould, of Red Lion-street, Clerkenwell, (Middlesex,) gent.: specification of an invention of a hydrometer on a new principle, for the purpose of ascertaining the strength of spirits, and determining the specific gravity of fluids in general. Sept. 3, 43 Geo. 3; Oct. 3, 1803.

George Alderson, of Carnaby-street, in the parish of St. James, Westminster, (Middlesex,) lead pipe manufacturer: specification of a new invented manufacture of metal pipes, the same being lead lined with tin, in a manner and by a process entirely new, to be used in all cases to which lead pipes are applicable. Jan. 26, 44 Geo. 3; Feb. 25, 1804.

Robert Atkins, of Fenchurch-street, in the city of London, mathematical instrument maker: specification of an invention of certain methods of constructing, and several improvements in the construction of hydrometers, for ascertaining the strength of spirituous liquors, and an invention and adoption of a sliding rule of correction for tem-

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perature to the hydrometer, and various improvements thereof. Oct. 31, 44 Geo. 3; April 30, 1804.

Joshua Jowett, of High Holborn, (Middlesex,) ironmonger: specification of a new fire guard stove, whereby accidents from fire in houses, and other places that have heretofore been occasioned by grates and stoves, made on any other construction, are effectually prevented, and which will render the usual fire guards for children, and other purposes, unnecessary. May 18, 44 Geo. 3; June 14, 1804.

Timothy Bentley, of Lockwood, in the parish of Almondbury, (York,) common brewer: specification of a new method of purifying musty casks, and seasoning new ones. June 19, 44 Geo. 3; July 9, 44 Geo. 3, 1804.

Thomas Noon, of Burton-upon-Trent, (Stafford,) watchmaker: specification of a new invented threshing machine, with loose beaters, [having less friction than any hitherto known, and which consequently does more work with the same power, and less injury to the straw.] Oct. 30, 45 Geo. 3; Nov. 28, 1804.

James Barrett, of Saffron Walden, (Essex), smith and ironmonger: specification of an improvement in the construction of malt kilns, so as to prevent damage by fire, and to save fuel in the drying of malt. Jan. 29, 45 Geo. 3; Feb. 26, 1805.

James Ryan, of Doonane, (Queen's County, Ireland,) engineer: specification of an invention of sundry tools, implements, or apparatus, for boring the earth for coal, and all kinds of minerals, and subterraneous substances, by which the different strata may be cut out in a cheap and expeditious manner, in cores or cylinders, from 1 to 20 inches in length, and from 2 to 20 inches in diameter, so as to be taken up entire, at any depth that has hitherto been bored, by which not only the quality of such minerals and substances, but also the declination or dip of the strata, can be ascertained beyond a possibility of mistake, and which tools, implements, or apparatus, are also applicable to the purpose of sinking for wells, and giving vent to subterraneous water in bogs, and draining mines and grounds, and ventilating pits, and other beneficial purposes. Feb. 12, 45 Geo. 3; Feb. 28, 45 Geo. 3, 1805.

Barker Chifney, of London, gent.: specification of a new invented composition, to be used in washing, in order to render muslins and linens beautifully white, and also for other purposes. Sept. 14, 44 Geo. 3; March 13, 45 Geo. 3, 1805.

Edward Shorter, of New Crane, Wapping, (Middlesex,) mechanic: specification of an invention of certain mechanical apparatus, by which the raising of ballast is rendered more easy, cheap, and expeditious, and which may also be applied to other useful purposes. Jan. 16, 45 Geo. 3; April 15, 1805.

George Alexander Bond, of Hatton-garden, in the parish of St. Andrew, Holborn, (Middlesex,) gent.: specification of improvements on the construction of clocks and other time-keepers, whereby they are rendered of much greater utility and service, both by land and sea, denominated Nocturnal or Night Clocks, as also in the dial plates of clocks, watches, and other time-keepers, made on an entire new plan [illuminated clocks.] March 26, 45 Geo. 3; April 19, 45 Geo. 3.

William Everhard Baron Van Doornik, of Well-street, (Middlesex:) specification of an invention of certain compositions, formed by uniting an absorbent or detergent earth with other ingredients, so as to render the same more effectual in washing or scouring, and for various purposes to which soaps, or detergent earths are now applied. A receipt is also given for making the same effective in washing in sea water. Dec. 19, 45 Geo. 3; April 18, 1805.

James Sharples, of Grosvenor-place, Bath: specification of invented combinations and arrangements of implements and mechanical powers, and certain principles and forms of tables, useful for surveying, and various other purposes. Nov. 24, 44 Geo. 3; May 18, 1805.

Robert Barber, of Bilborough, (Notts,) gent.: specification of some new and improved modes of making and shaping stockings and pieces, and also some new and improved kinds of stocking stitch, and warp work, applicable to various purposes. June 14, 45 Geo. 3; July 13, 1805.

Job Rider, of Belfast, (Antrim, Ireland:) specification of "Certain improvements on the steam engine," consisting in,—1. Lining the steam cylinder with a soft metal, or a composition of metals similar to hard pewter, of a sufficient thickness to admit of finishing the inside of the cylinder, of such metal, by drawboring or otherwise. 2. Applying a hollow piston-rod, answering the purpose of an eduction pipe. 3. The order of opening and shutting the valves. 4. Regulating the engine's speed by a pendulum. March 26, 45 Geo. 3; April 22, 1805.

Barrodal Robert Dodd, of Change-alley, in the city of London, civil engineer: specification of new invented various improvements in the construction of fire-places, and adapting stoves and grates thereto [with reflectors, &c.] April 18, 45 Geo. 3; August 15, 1805.

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[The portion of the Calendar which follows is taken from what is called the "Close Rolls." The preceding portion has been extracted from the "Specification and Surrender Rolls."]

John Nasmyth, of Hamilton, in North Britain, apothecary: for a new invention for the preparing and fermenting of wash from sugar, molasses, and all sorts of grain, to be distilled. Cl. R., 11 Anne, p. 7, No. 24. Oct. 3 last past; April 1, 1712, 11 Anne.

Aaron Hill, esq.: for expressing a sweet and wholesome oil from a good and wholesome vegetable of the growth of Great Britain, viz., the triangular seed of the beech tree. Cl. R., 12 Anne, p. 8, No. 10. Oct. 23 last past; Nov. 6, 12 Anne, 1713.

James Puckle, of the city of London, gent.: patent, enrolled pursuant to warrant of M.R., for the sole benefit, profit, and advantage arising from a portable gun or machine called a Defence, that discharges so often and so many bullets, and can be so quickly loaden as renders it next to impossible to carry any ship by boarding. Attached is a parchment schedule, consisting of a print of the invention, and the specification thereof, signed and sealed, but not acknowledged. Cl. R., 5 Geo. 1, p. 4, No. 21. May 15, 4 Geo. 1; July 25, 1718.

Benjamin Robinson and *Francis Hauksbee*, of the city of London, esqrs.: for a new method of preserving the plank and sheathing of ships sailing to the East and West Indies, and other parts of the world, in a more secure and lasting manner, than by any method hitherto practised, and will greatly tend to the preservation of those ships, which in the course of their voyage pass through or remain long in those seas where the worm abounds. Cl. R., 2 Geo. 2, p. 14, No. 12. May 9, 1 Geo. 2; Sept. 13, 2 Geo. 2, 1728.

Henry Browne, esq.: for a new method of making cannon or great guns, both in iron and brass, which will be much shorter, lighter, and with less powder, carry further than those of equal bore now in use, whereby a considerable expense may be saved both in metal and powder, heavy burdens lightened, and an enemy annoyed with more readiness of hand than has hitherto been discovered; also field pieces of good force may hereby be rendered so portable as one of them to be carried by a single horse or mule, upon an expedition where wheel carriage cannot conveniently be brought up. Cl. R., 2 Geo. 2, p. 15, No. 17. Oct. 5, 2 Geo. 2; Nov. 2, 2 Geo. 2, 1728.

Captain *Robert Hamblin*: for a new method for distinguishing of lights, whereby one light erected for the guidance of shipping may be perfectly known from another, and consequently every ship's crew or single mariner be informed and know where they are or what coast they are off, as well in the night as if it were day. Cl. R., 4 Geo. 2, p. 9, No. 21. July 4 instant; July 21, 4 Geo. 2, 1730.

Jacob Rowe, gent.: for an effectual means for taking off or cancelling the friction of the wheel pulley balance and pendulum, &c., whereby, firstly, land carriages on wheels will require a far less draught of horses; and secondly, it will be practicable by an additional contrivance to cause one or the same power to act manifold more swiftly than usual, or with one and the same power to lift up greater weight than usual in the common time of performance. Cl. R., 7 Geo. 2, p. 1, No. 1. Feb. 1, 7 Geo. 2; March 22, 1733, 7 Geo. 2.

Anthony Parsons, of Sheffield, (York,) gent.: for an engine very useful for supplying of towns, seats, houses, and gardens, with water; and also for raising of water out of mines or pits, and at the same time, or at different times and separately, for drawing up of ore, coal, or other minerals, as there may be occasion; which said engine may be worked by men, horses, water, and wind, at the same time, or by any one or more of the said powers separately or together. Cl. R., 8 Geo. 2, p. 28, No. 9. Sept. 12, 8 Geo. 2; Sept. 27, 8 Geo. 2, 1734.

Obadiah Wyld, of London, gent.: for a new invention of making or preparing paper, linen, canvass, and such like substances, which will neither flame nor retain fire, and which hath also a property in it of resisting moisture and damps. Cl. R., 9 Geo. 2, p. 1, No. 23. March 17 last past; April 15, 1735, 8 Geo. 2.

Joshua Coles, of the city of London, colourman: for a liquid blue. Cl. R., 9 Geo. 2, p. 7, No. 1. Feb. 14, 9 Geo. 2; March 18, 9 Geo. 2, 1735.

Jonathan Hulls: for a machine for carrying ships and vessels out of or into any harbour and river against wind and tide, or in a calm. [Steam-boat.] Cl. R., 10 Geo. 2, p. 6, No. 6. Dec. 21, 10 Geo. 2; March 7, 10 Geo. 2, 1736.

John Watts, of London, merchant: for a new invention of building the body or lower works of a ship, pink, brig, sloop, boat, and all other marine vessels by what name soever called or distinguished, which said new invented form being nearer than any other to the solid of least resistance, will both carry a greater burthen and sail or row much better than any other form hitherto built or made use of, and will likewise have all such other good qualities as can be desired in a marine vessel, and so will be less

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liable to shipwrecks by being driven on lee shores, or by other accidents, than the vessels now in use. Cl. R., 10 Geo. 2, p. 7, No. 13. May 22 last past; July 15, 1736, 10 Geo. 2.

Alexander Emerton, of the parish of St. Clement Danes, (Middlesex,) colourman: for a new invention of covering and painting the timbers, planks, and boards of ships, yatchs, &c., or vessels of any sort; and likewise the timber, boards, and plastering, in building, or anything that may be covered or painted according to my new invented method. Cl. R., 11 Geo. 2, p. 7, No. 27. June 13, 11 Geo. 2; Sept. 3, 1737.

John Barston, of Battersea, (Surry,) watchmaker: for an instrument newly invented, and called an Universal Astronomical Quadrant. Cl. R., 12 Geo. 2, p. 4, No. 6. Dec. 21, 12 Geo. 2; Feb. 13, 1738.

Lewis Paul, of Birmingham, (Warwick,) gent.: for a new invented machine or engine for the spinning of wool and cotton, in a manner entirely new. Cl. R., 12 Geo. 2, p. 20, No. 20. June 24, 12 Geo. 2; July 20, 1738.

William Crispe, of the parish of St. Michael, in the city of Bristol, esq.: for a double shaft and pole carriage, to cross the ruts, and go with two wheels and two horses on abreast, together with proper harness for the same, fit to carry either a chaise, coach, &c., or any other conveniency of that or the like nature. Cl. R., 14 Geo. 2, p, 8, No. 7. Aug. 9, 14 Geo. 2; Nov. 1, 1740.

John Tull, of the parish of Shalbourn, (Berks:) for a certain machine called a Flying Sedan Chair, fixed upon wheels. Cl. R., 14 Geo. 2, p. 16, No. 20. May 15, 13 Geo. 2; Aug. 6, 1740.

John Wise, of Coventry, engineer: for a machine or model for the more extensive use and application of the fire [steam] engine, whereby fire, by the help of a circular motion, communicated by a perpendicular stroke from the engine, can, with the assistance of so small a stream of water as two hogsheads by the hour, do the same work as those mills that require one thousand hogsheads by the hour, and may be applied to the same uses. Cl. R., 14 Geo. 2, p. 17, No. 7. Aug. 7, 14 Geo. 2; Oct, 11, 1740.

Joseph Taylor, of Ryegate, (Surry,) yeoman: for a new invention of a water machine, whereby a less power or force gives liberty for obtaining a greater, without wasting any of the fluid employed in the operation; by which machine not only perpetual motion is effected, but also a very great degree of force will be at liberty for perpetual service. A paper schedule of drawings of the invention is attached. Cl. R., 15 Geo. 2, p. 4, No. 29. May 29, 15 Geo. 2; Aug. 20, 1741.

Gilbert Hadley, of Bristol, gunsmith: for a new invention of a piece of ordnance or cannon. Cl. R., 15 Geo. 2, p. 14, No. 16. June 4, 14 Geo. 2; Sept. 29, 1741.

John Baskerville, of Birmingham, japanner: for making and flat grinding by a machine thin metal plates, and of working or fashioning the same by the help of iron rolls and swages, either into mouldings (of any size or form) or planes as exactly true and level as the best joiner can perform the like in wood, which specifier proposes to japan or varnish when so ground and fashioned, and to apply the same to the following subjects (to wit,) to veneer the frames of paintings and pictures of all sizes, looking-glass frames, the fronts of cabinets, bureaus, &c., now usually veneered with ebony, whalebone, &c.; (the said plates so prepared, japanned or varnished being more beautiful and durable, and in all respects answer better than anything hitherto applied to the same purpose, as the same will produce a fine glowing mahogany colour, a black no way inferior to that of the most perfect India goods, or an imitation of tortoiseshell which greatly excels nature itself both in colour and hardness, and each colour admitting of the most perfect polish, whose beauty, without violence, will not be impaired in several ages.) Cl. R., 16 Geo. 2, p. 10, No. 24. Jan. 16, 15 Geo. 2; May 1, 15 Geo. 2, 1742.

John Hooper, of Reading, apothecary: for a new invented medicine prepared in part chemically, and compounded of several ingredients now commonly called by the name of the Female Pills. Cl. R., 17 Geo. 2, p. 1, No. 9. July 21, 17 Geo. 2; Nov. 1, 1743.

James Hamilton, of Westminster, gent.: for a new invention or engine for taking of fish which comes within one thousand yards, or any less distance of the land or shore. For a description of the invention the deed refers to a drawing, which is not attached. Cl. R., 17 Geo. 2, p. 10, No. 4. Sept. 14, 17 Geo. 2; Jan. 9, 1743.

William Perkins: for a machine for grinding corn, drawing up great weights, as coals, &c., and to force up water with a perpetual stream for the supply of cities, seats, &c. Cl. R., 18 Geo. 2, p. 15, No. 4. Sept. 6, 18 Geo. 2; Dec. 13, 1744.

John Kay, of Bury, gent., and *Joseph Stell*, of Kighley, gent.: for an engine or loom for working and weaving of tapes, and all other goods, in narrow breadths, made of woollen, linen, silk, cotton, and mohair; and also a new invented kiln for the drying of malt; and likewise a new invented pan or kettle for saving of fuel in the making of common salt. Cl. R., 19 Geo. 2, p. 3, No. 12. April 18, 18 Geo. 2; May 14, 18 Geo. 2, 1745.

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Samuel Sage, of the parish of St. Saviour, Southwark, (Surry,) carpenter: for an engine or machine for the cutting of tobacco. Cl. R., 21 Geo. 2, p. 8, No. 14. May 12, 1747; Sept. 3, 1747.

(*To be continued.*)

LIST OF ENGLISH PATENTS GRANTED FROM FEB. 20, TO FEB. 25, 1847.

Joseph Clinton Robertson, of Fleet-street, civil engineer, for certain improvements in distillation and brewing, and certain applications of the materials used in or suitable therefor to other manufacturing purposes. (Being a communication.) Feb. 20; six months.

Edward Brown, of Adams-court, London, gent., for certain carbonic compounds formed of earth, vegetable, animal and mineral rubbish, fecal substances, the waste of manufactories, and certain acids and alkalies, which compounds are applicable as manures. (Being a communication.) Feb. 20; six months.

William Pidding, of Bernard-street, Middlesex, gent., for an improved process, or improved processes for preparing certain vegetable extracts, and also for preserving the aroma of certain vegetable substances from the atmosphere. Feb. 20; six months.

William Bayliss, of Bilston, Stafford, chain maker, for a machine for flattening and turning iron links for flat wood slub chains. Feb. 20; six months.

George Russell Dartnell, a staff surgeon of the first class in her Majesty's Army, for an improved truss for inguinal hernia. Feb. 20; two months.

Alphonse le Mire de Normandy, of Bethnal-green, Middlesex, for improvements in the manufacture of zink. Feb. 20; six months.

Frederick Walton, of Wolverhampton, japanner, for an improved mode of coating or covering, or of coating, covering, and ornamenting the surfaces of articles which are or may be made of wrought iron, or of other metal or metals; which improved mode may be used in substitution of japanning, tinning, or other modes now in common use of coating, covering, or of coating, covering, and ornamenting such articles. February 24; six months.

Juan Nepomuceno Odorno, of Mexico, in the Republic of Mexico, gentleman, for improvements in the manufacture of cigars and other similar articles. February 24; six months.

John Lowe, of Manchester, civil engineer, and James Simpson, of the same place, joiner, for certain improvements applicable to carriages to be used upon railways, part of which improvements may also be used upon other roads. February 24; six months.

William Todd, of Holcombe Brook, near Bury, Lancaster, for certain improvements in the method of sizing and dressing yarns, and in the machinery or apparatus for performing the same. February 24; six months.

Frederick Ransome, of Ipswich, engineer, for improvements in working coke and other kilns or ovens. February 24; six months.

Charles Heard Wild, of Mortimer-street, Cavendish-square, Middlesex, for improvements in constructing parts of railways. February 24; six months.

Charles Fox, of London Works, Birmingham, for a method or methods of welding or uniting pieces of metal together, and of preserving or forming pieces of metal into forms or shapes. February 24; six months.

Robert Snowden, of 7, City-road, Middlesex, tea-dealer, for improvements in treating or dressing coffee to render it more wholesome for use. Feb. 25; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 25TH OF JANUARY TO THE 22ND OF FEBRUARY, 1847.

Samuel Cunliffe Lister, of Manningham-house, Bradford, York, esq., for improvements in preparing and combing wool. Sealed January 25.

Edward Cobbold, of Mellford, Suffolk, clerk, M.A., for improvements in the preparation of peat, rendering it applicable to several useful purposes, particularly to fuel. January 25.

Matthew Gibson, of Wellington-street, Newcastle-upon-Tyne, machine-maker, for a machine for reaping and cutting grass, and other similar purposes. January 26.

Henry Bessemer, of Baxter-house, Old St. Pancras-road, Middlesex, engineer, for certain improvements in the manufacture of glass, and in the machinery and apparatus connected therewith, and also in silvering and coating glass, parts of which improvements are applicable to the manufacture of tin foil, and thin sheets of other metal, or alloys of metal. January 28.

John Thompson Carter, of Drogheda, in the county of the town of Drogheda, Ireland, flax-spinner, for improvements in machinery for crushing, bruising, and preparing flax, hemp, and other fibrous materials requiring such treatment. January 29.

Richard Walker, of Rochdale, Lancaster, cotton-spinner, for certain improvements in the apparatus for the manufature of gas for illumination, which said improvements are also applicable to the manufacture of other products of distillation. January 29.

Stephen R. Parkhurst, of Leeds, York, manufacturer, for improvements in rotatory engines. February 4.

Moses Poole, of the Patent Office, London, gent., for improvements in the manufacture of terry and cut piled fabrics. (Being a communication from abroad.) February 4.

William Nicholson, of Manchester, Lancaster, engineer, and George Wadsworth, of Sutton Glass Works, in the same county, manager, for certain improvements in the manufacture of glass, and other vitreous products. February 4.

Richard Albert Tilghman, of Scott's-yard, Bush-lane, London, and of the United States of America, chemist, for improvements in the manufacture of certain acids, alkalies, and alkaline salts. Feb. 4.

Richard Albert Tilghman, of Scott's-yard, Bush-lane, London, and of the United States of America, chemist, for improvements in the manufacture of certain alkaline salts. February 4.

Egbert Hedge, residing at No. 7, Howard-street, St. Clement's Danes, Middlesex, gentleman, for certain improvements in rails for railways, and in the manner of securing them. February 5.

John Donkin, of Grange-road, Bermondsey, Surrey, civil engineer, for improvements in the manufacture of paper, or in the machinery employed therein, and in the process of bleaching paper, linen, and other manufactures in which chloride of lime is employed. (Being partly a communication from abroad.) February 8.

James Yates, of Masborough, Rotherham, York, engineer and iron-founder, for improvements in the construction of blast furnaces. February 10.

Thomas Du Boulay, of Sandgate, Kent, Esq., and John Du Boulay, of Buckshaw, Dorset, Esq., for improvements in fitting up granaries and warehouses, and of getting into condition and preserving therein grain, pulse, seeds, malt, and other perishable articles. February 10.

Enoch Wilkinson, of Oldham, Lancaster, overlooker, for certain improvements in looms for weaving. February 15.

Juan Nepomuceno Adorno, of Mexico, in the Republic of Mexico, gentleman, for improvements in manufacturing cigars and other similar articles. February 22.

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LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Jan. 29	939	Horne, Thornthwaite and Wood.........	Newgate-street, London, opticians, and philosophical instrument makers.............	Improved design for a portable case for holding photographic or calotype plates, or sheets of paper.
,,	940	James Cartland & Sons	Birmingham......................	Self-closing vertical plate for letter boxes.
30	941	William Rileigh	1, Stewart's-place, Brixton-hill	A crown head invalid chimney top and ventilator.
Feb. 1	942	Langford and Bristed...	9, Gresham-street, London....	The back shell of a die and pressure-made button.
,,	943	John Walker............	48, Shoe-lane, London, carpenter and back maker............	Pendent-air trap.
,,	944	William Rivett & Sons	50, Crown-street, Finsbury-sqr.	Telescopic-table frame.
,,	945	Robert Clarke	Clitheroe, iron & brass founder	Oven saddle.
2	946	Morris Levinson	5, Trinity-place, Charing-cross...	Self-adjusting clog.
,,	947	Abraham Marbe.........	Bridgewater, Somerset, chemist,	Galphonum spirit or oil lamp.
4	948	James Freeman..........	7, Little Chester-street, Grosvenor place, Pimlico, millwright	Sugar mill.
,,	949	Thomas Pugh.........	13, King-street, Snow-hill, London	Fastenings for locks, and their accompanying box staples.
5	950	Robert Bowie	Fowke's-buildings, Tower-street, surgeon	Ventilating-window pane.
6	951	Pretyman and Hobson	17, Cornhill, London................	Lamp.
,,	952	Thacker and Rudford...	Hodson's-square, Manchester...	Demi-shirt.
8	953	William Marshall.....	10, Victoria-terrace, Wynne-st., Birmingham, gas-burner maker.	Air heater and distributor for gas burners.
,,	954	Vincent Price	33, Wardour-street, Soho........	Improved economical ironing stove.
9	955	John Finlay...............	Glasgow................................	Improved chimney top.
11	956	William Palmer..........	Sutton-street, Clerkenwell........	Glass of a lamp.
,,	957	Wm. Thorowgood and Robert Besley.........	Fann-street, Aldersgate-street, London, letter founders........	Court-hand printing type.
12	958	John Fleetham.........	North Dalton, near Beverley, Yorkshire, joiner, wheelwright and machine maker.............	Turnip cutter.
,,	959	Carpenter Tildesley......	Willenhall..............................	Door lock.
13	960	Lockwood Brothers......	Sheffield	Improved mortise gauge.
,,	961	Edward Owen............	Northumberland-street, Strand.	Brace.
15	962	E. Dench..................	Hurstpierrepoint, near Brighton..................................	Metallic-sash frame for greenhouses, hothouses, forcing pits, and other like horticultural purposes.
16	963	William Ford.............	10, Holles-street, Cavendish-sq.	Lady's riding habit.
,,	964	Charles Massi	31, Noble-street, Goswell-street.	Percolating-galvanic trough.
17	965	George Phillips Bayley	146, Fenchurch-st., City, brush manufacturer	Expanding brush for tubular boilers.
17	966	Henry Pringle Bruyeres	Euston-square, London, superintendent of the London and North Western Railway	Day and night transparent auxiliary signal for railway lamps.
18	967	Miller and Sons	179, Piccadilly, London..............	Lamp.
,,	968	Peter Stevenson..........	9, Lothian-street, Edinburgh, philosophical instrument maker............................	Saucer valve and metallic screen for preventing the transmission of flame to combustible materials.
19	969	John Young	Ayr, engineer	Machine for the manufacture of draining tiles, &c.
,,	970	Fenton and Marsden...	Sheffield.................................	Improved mortise gauge for cabinet-makers, joiners, &c.
20	971	John & Wm. Besemeres	Wood-street, Cheapside, London	Club-house shirt.
22	972	Huxley, Heriot and Co.	Castle-street, Long-acre, ironmongers..............................	Economic gas-stove.
,,	973	Robert Bowie	1, Fowke's-buildings, Great Tower-street, City, surgeon,	Tile for baths, washhouses, dairies, &c.
23	974	Wm. Bedington, Jun....	Birmingham.........................	Improved burner and glass holder.
24	975	Alexis Soyer of the...... and John Thomas Prestage, and Wm. Ball, both of the firm of Bramah, Prestage and Ball..................	Reform Club, Pall-mall......... 24, Piccadilly, London	Tendon separator.
,,	976	Thomas Taylor Fountaine	46, Albemarle-street, Piccadilly, London	Mantle coat.

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CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1230.] SATURDAY, MARCH 6. [Price 3*d*.
Edited by J. C. Robertson, 166, Fleet-street.

FLOATING BREAKWATERS.

Fig. 8.

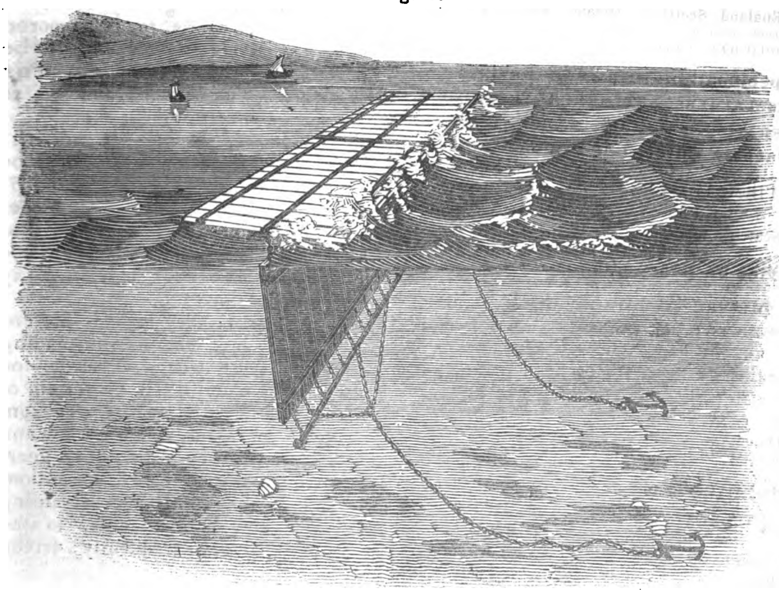
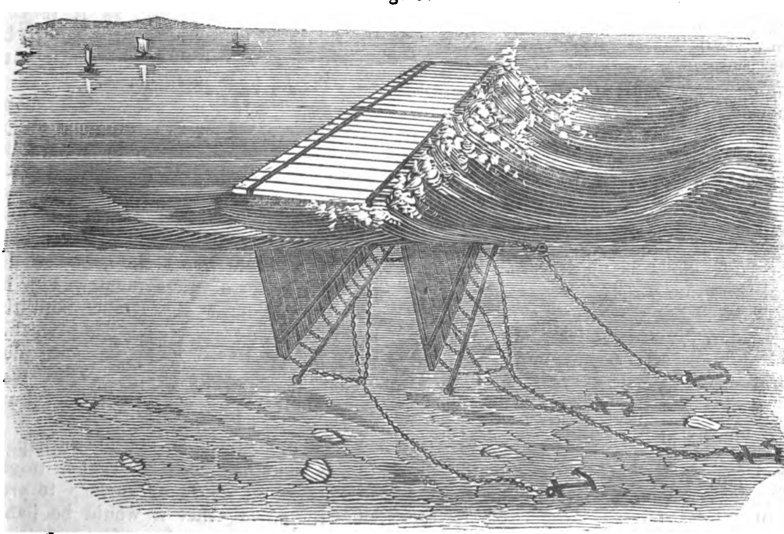


Fig. 9.



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FLOATING BREAKWATERS.

NAVAL men are generally very much averse to the idea of floating breakwaters. They feel, and very naturally, a reluctance to trust shipping under the sole protection of a frail, floating substance, which it would seem no precaution could secure from a possibility of being broken through, or carried away.

Still, if not for general or permanent, there are at least many important temporary and partial services, that would be rendered by a floating breakwater, if of easy construction and application, and not attended with heavy expense.

Many principles have been proposed for the purpose, and some have been tried, but, hitherto, none appear to have obtained much confidence.

Doubts, indeed, have been expressed by gentlemen of considerable science and attainments, (and more than doubts by some,) that no artificial floating construction can have the effect of procuring still water inside during times of a great swell.

It is very desirable that this preliminary objection should be well considered; since, if very generally entertained by professional men, a check might be put upon experiments attended with considerable expense, and, thus derided, to be little likely to succeed.

Should there be, however, a divided opinion on the subject, it may be well to consider the system most likely to answer: and if one can be devised, as I am inclined to believe there can, of simple and inexpensive construction, there will be the less difficulty in making trials.

Of natural floating breakwaters, two are to be met with in the ocean:

1. Weeds in south latitudes that rise to the surface from great depths in the sea, and in wide rivers and inland lakes; the same effect is produced on a small scale by other weeds.

2. Field ice.

It may be argued that both of these act by their vast extent, and I am not aware of it being on record what is the minimum amount of either that will produce the effect; but they prove that, if in sufficient quantity, the water may be stilled by floating substances, and the question is, whether that sufficiency, if artificial, is out of proportion to the benefit sought from its application?

The floating breakwater, usually proposed, has been some kind of skeleton of a vessel or caisson, strongly braced, but unplanked, so that the sea might find vent through the interstices between the ribs, by which it is argued its force against it would be greatly reduced; a line of such rafts to be moored head and stern across the opening to be protected, and consequently presenting their broadsides to the wind and sea, to which the anchorage is most exposed.

Independent of the expense and difficulty of such structures, which must be put together in dockyards or large shipbuilding premises, and that of its subsequent maintenance, it is submitted that it would be impossible to prevent these rafts being occasionally carried away from their moorings.

The opposition they would present to the wind and sea, notwithstanding their open lattice work, would be too great for any moorings to be certain of resisting; this may be well inferred from the case of light ships, which are low and compact, have very little upper gear, and are moored with every precaution, swinging to the wind, and presenting only their bow and cut-water to the wave, and yet are frequently driven away.

The possibility of such a circumstance happening to any section of a breakwater, endangering, as it might, the safety of everything proposed to be protected by it, must cause the system to be received with great doubt.

A construction was proposed by Captain Groves, which consisted of a cylinder of wrought iron, about 6 feet in diameter, and 30 or 40 feet long, with a grating about 10 feet deep of cast-iron bars suspended to its under side, and slung to the cylinder so as to move or yield in some degree to the action of the wave; a series of these floats was to be connected together by chains, and the moorings made fast to each end; so that there would be as many anchors, plus one, as there were floats. One was moored off Dover, but was driven ashore in a gale.

The objections I should anticipate to this structure would be that it might be wanting in depth or surface to produce the effect; that it would be liable to be carried away from its moorings,

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and to accidents that might cause it to sink. In the *Transactions of the Society of Arts*, vol. liv., (1843,) Major Parlby

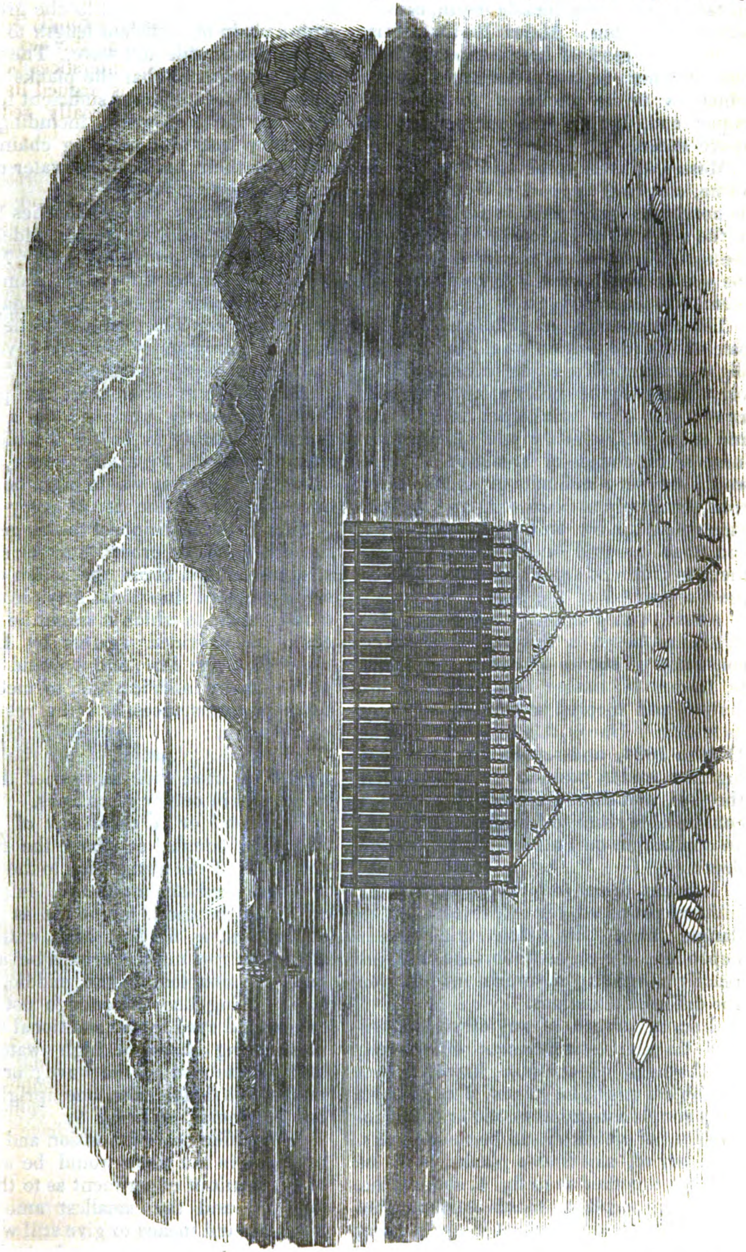

Fig. 1.

has given a description of a mode by which he proposes to imitate the

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effect of the trumpet-weed which is found on the coasts near the Cape of Good Hope, and which, rising to the surface from a considerable depth, causes still water within. Major Parlby forms an artificial reed of long strips of deal put together in a particular manner, which is to be anchored, so that the upper end, by its buoyancy, may be above water.

Masses of these to be laid together in a line, covering the part to be protected, he conceives would yield in all directions to the sea, and act precisely in effect as the natural reed does, admitting, as with the natural weed, vessels to pass through them without injury.

The objections which I should anticipate to this proposition would be, that so slight a material in all its parts would be very liable to be broken and carried away; that they would get intermixed and entangled, which would also tend to increase the chance of breakage; that it would be very difficult to anchor each reed separately as proposed, and so that each should have sufficient buoyancy; and that it would be difficult to adjust them to different depths of water, and to the rise and fall of the tides.

About twenty or thirty years ago, Mr. White proposed a floating breakwater consisting of square skeleton *flat* rafts, or frames of timber, strongly put together, and moored separately, each by its middle. One of this kind was tried at Deal in 1824, and reported to have held together, and in position; to have broken the seas, and caused smooth water for a considerable space to leeward. This was an application on the surface, and had no depth.

It seems to me to be the best of those hitherto proposed, but is I think liable to danger from being in rigid masses dependent on single moorings, and not readily admitting of much modification for different situations.

I am not aware of any other proposition for the establishment of floating breakwaters. I consider, however, that the object might be gained, if at all, by a very simple construction, the principal ingredient of which should be stout planks.

A bay of, say twelve planks, is to be coupled together as in fig. 1, about 2 ins. apart, in two places, that is at about a foot from either end, by pliant joints, making a length of about 12 feet.

An iron rod, A B, is to be fixed by a short chain to one end of each plank, and that rod, moored by its middle, (or by coupling chains, *a b*,) to the ground, with a chain of sufficient length to allow of the rise of tide and wave. The whole to be so adjusted that the planks would possess a buoyant power sufficient to support all the iron-work, including the necessary length of mooring chain, and still have their heads above water at the height of spring tides.

Twelve planks, each of 3 inches thick, 10 feet long, and 10 inches wide, will give a buoyant power of nearly 7 cwt., which it is considered would be ample.

Any number of such bays may be placed and coupled together in the same manner contiguously, so as to cover the space requiring protection.

At low water in a calm the planks would be nearly upright; in a light breeze, probably as in fig. 2; blowing strong, as in fig. 3; at high water, as in figs. 4 and 5: they would also be more or less sunk with the rise of every wave.

Such is the principle of the suggestion, but it is yet to be proved how far such a structure would stand the action of the sea in exposed situations. Any occasional derangement to which it might be liable could be provided against by having more than one line, and it would admit of very many modifications, to meet different circumstances and the results of experiment.

Thus, the planks and all the parts might be tried with any varied dimensions, and in one or more lines.

A second or a third row of planks might be coupled on above the first, if the depth of the obstruction to the waves is considered advantageous; in which case, the position might be as fig. 6 at low, and as fig. 7 at high, water; or the upper row might perhaps be advantageously coupled in the middle, as in fig. 8, being buoyant enough not to be submerged even by the additional weight of mooring chain at high water, including the rise of the wave; or there might be a double row, one upright, and one horizontal, as in fig. 9.

This difference of position and depth of plank in the water would be adapted to the result of experiment as to the best position, and the smallest amount of planking and means to give still water.

It is proposed that each plank shall be

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bound round by hoop or thin iron at about a foot from each end, as the fastening for the couplings, and to prevent the boards splitting.

Every coupling should be strong, perfectly pliant, and put together in such manner by a bolt or otherwise, as, while holding securely when in position, to be very readily separated when raised out of the water for repairs.

Instead of planks, perhaps baulks or half baulks of timber, for parts or for the whole, might prove necessary.

An anchor of $1\frac{1}{2}$ cwt., and a $\frac{1}{2}$-inch

Fig. 4.

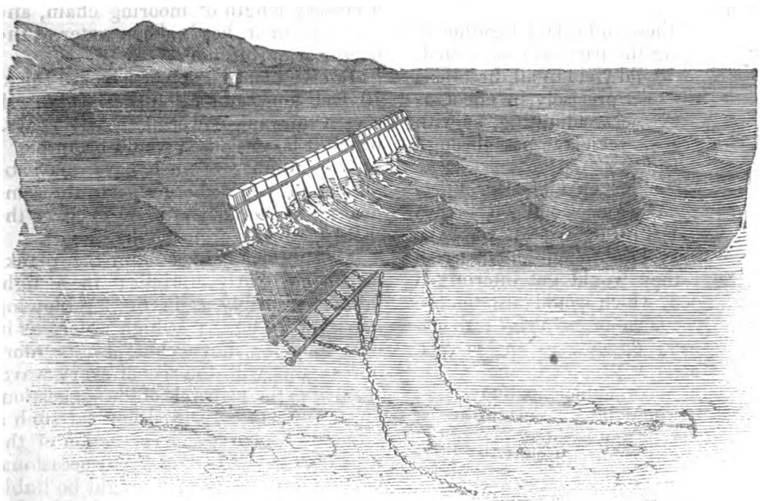
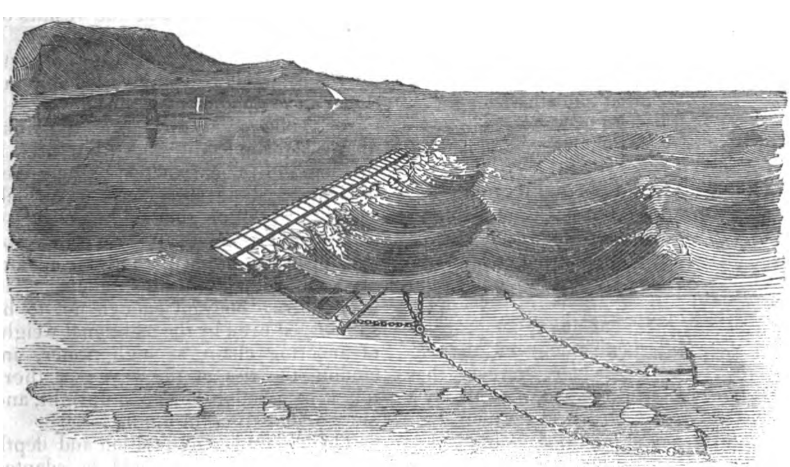


Fig. 5.



chain mooring cable, it is considered would be quite, or more than sufficient for each bay.

The bar, A B, should be somewhat under the required weight, which might be made up by distinct additions of chain,

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or otherwise to be removed or added to at pleasure for adjustment.

The moorings thus proposed would meet the case of the wind bearing *across* the line in either direction. In order to be prepared for periods when it shall

Fig. 3.

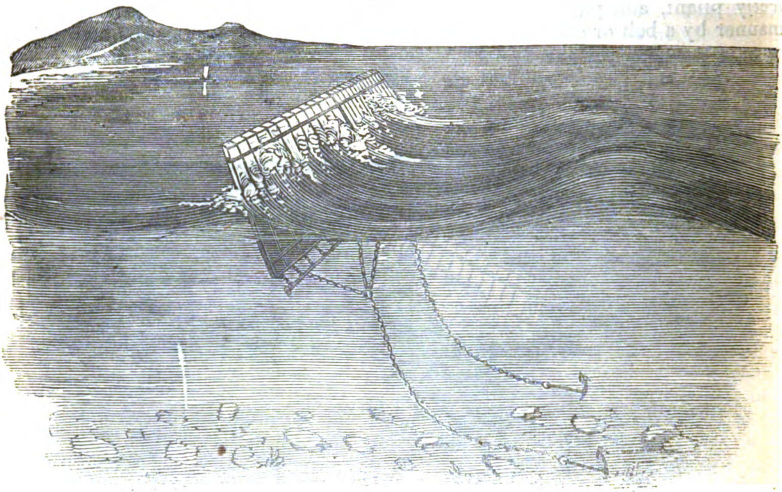
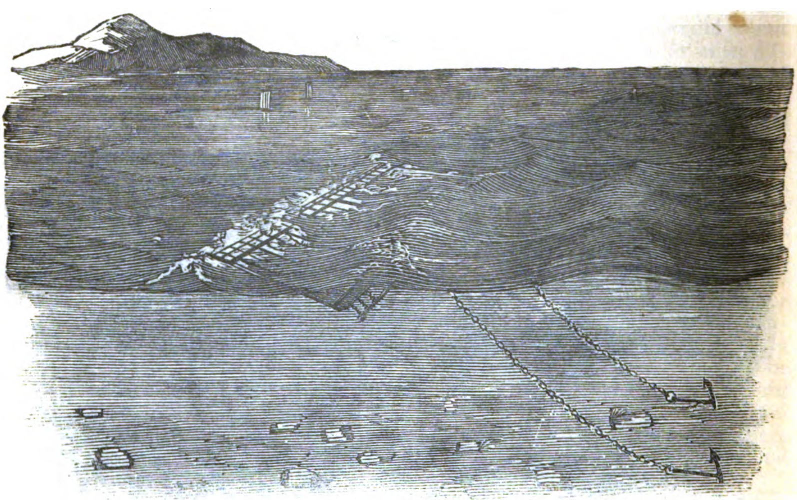


Fig. 2.



blow more or less *along* it, there will be a necessity for a strong mooring and buoy at either end, to prevent the planks being heaped and rubbed against one

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another by the effect of such end wind; but in general the wind from that direction would be off shore, and consequently not acting upon it with great force.

Fig. 6.

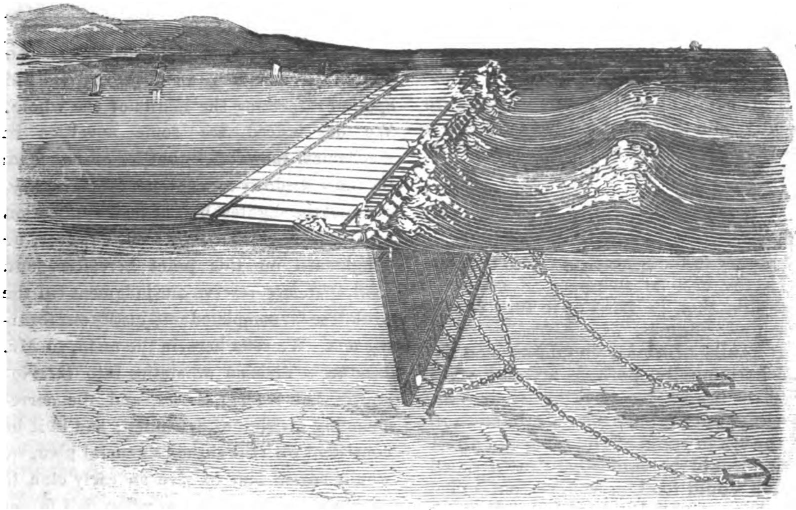
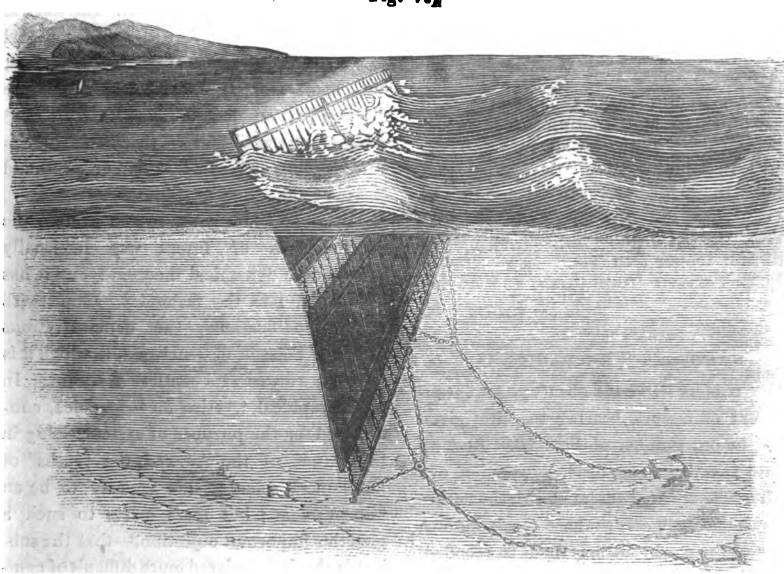


Fig. 7.



Should this principle be found to be available, it would be attended with many advantages;

1. No difficulty nor much expense in construction.

2. The materials to be found anywhere, or very easily procured.

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3. A power of infinite modification in extent of means, to be applied to suit any locality or object.

4. Great facility of taking up, examining, repairing or replacing any part of it; a moderate lighter would be quite sufficient for the purpose.

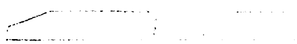
5. It could be laid down and taken up rapidly, and thus used temporarily, or on trial anywhere, the materials being little injured, or even altered by the application.

6. It is considered that ships would be able to cross it in case of necessity without injury to themselves or the apparatus.

In the case of steamers, it might be desirable that in passing it they should stop their engines.

If baulks of *timber* should be used and laid horizontally, perhaps a vessel might receive injury by striking their *ends* forcibly; but the ends towards the strength of the sea in some of the modes of application would be somewhat drawn down, which would tend to relieve that effect, or they might be bevelled off, as in fig. 10.

Fig. 10.



Although there may be so much repugnance to allowing new anchorages to be formed of any floating breakwater, by which ships might be led into danger, there can be none to an attempt by such means to cover any partially exposed part of existing anchorages or landing places, which ships have used and must continue to use; in such cases benefit may be derived from them, and no injury.

HEATHER'S "MECHANICS."*

Our readers will have observed an advertisement of a work bearing the title given below in our number of Feb. 20. Lest we should have been supposed, by some of our readers who are unacquainted with the nature of the book-business, to there speak our own views of the work, we beg them to recollect that *advertisements* are never to be understood in any other sense than as indicative of the *advertiser's own version* of the merits of a work or an invention.

The portion of the work before us, consisting of only forty-eight pages, is too limited to enable us to form any decided opinion respecting the merits of the whole. We do, indeed, see some novelties in mechanical *speculation*, but we cannot form the most shadowy conception of their *utility*,—as not the slightest hint of their application has yet been given. We may, however, be enlightened on this point hereafter, and shall, therefore, reserve our judgment till the work is so far completed as to justify our forming one. We refer here, in the main, to Mr. Heather's division of statics into *interio-statics* and *exterio-statics*, and the corresponding division of dynamics; and if it be consistent with the author's general plan, we would advise him to give an early clue to enable us to answer the question that forces itself upon us—*cui bono?*

On some other parts of the first number we can at once form an opinion. The work is evidently intended to furnish a philosophical as well as a mathematical treatise on forces; but, apart from the *possible* results of the division just alluded to, there is little that strikes us as new, and of that little there is still less that strikes us as either profound or far-seeing.

Till a comparatively recent period, the parallelogram of forces was habitually proved as a dynamical theorem: but it has become of late the fashion to adopt, with slight modifications, the demonstrations either of Poisson or Duchayla, in which it is *formally* viewed as a statical theorem. In a philosophical treatise on mechanics, constructed for the purpose of systematizing in the minds of the *learned* the truths of mechanical science, this appears to be an improvement; but there exists to such a plan this important objection,—that the subject is thereby rendered more difficult of comprehension by the student, from the more refined and abstract character of the conceptions which it requires him to form. In fact, the conception of the first clear mathe-

* "A Treatise of Mechanics. By J. F. Heather, B.A., of the Royal Military Academy, Woolwich; late Scholar of St. Peter's College, Cambridge. No. I. Weale: Deighton."

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matical idea of force is far more easily made from a consideration of the velocities produced by it, than from the resistance of a fixed body which is pressed by it; or, in other words, the dynamic conception of force is *naturally anterior* to the static. The inversion of this natural order, for the sake of a special system, appears to us to partake largely of that species of *scientific euphuism* that threatens to become the curse of modern science. We cannot consider any system which inverts the natural and inevitable order of our conceptions as tending to the promotion of science, however necessary it may be to bring all knowledge within the Procrustean limits of an arbitrary and artificial system of classification. A flower will not change its structure, nor an animal alter the number and relative dimensions of any of its organs, to accommodate the dictatorial systems of the naturalist. Why, then, should *abstract truth*,—truth, be it remembered, is absolute and independent,—why should abstract truth be cut into sections, and joined in other than their natural shapes, to suit the fancies of each uew phase of system-making? All we suppose that can be said is, the world *wills it*, —wills that we should be the slaves of this intellectual legislation; and that those who are doomed to the "delightful task," must comply with the mandates of that all-powerful oligarchy, that invisible and intangible everybody-nobody, "the scientific mind of the age."

Having ourselves no participation in the "delight" upon which Thomson was so eloquent, we possess, on the other hand, the delightful freedom of being able to judge for ourselves on all such questions. Our views are not altogether unknown to our readers, as they have been already stated in a former volume. They will, however, bear repetition. We consider, then, that *the parallelogram of forces is an experimental truth* ONLY, whether in statics or dynamics; and that all attempts to establish it upon other basis than this, from purely mathematical considerations, must ever fail, as all such ever have failed, to carry to the careful mind a full and firm conviction of its truth. No man who has rigorously examined any proof ever propounded to him can honestly affirm that the final conclusion logically follows from the original premises; and each successive speculatist readily detects the illogical processes of those who have trod the path before him. It is, indeed, very strange that it never occurs to those (often gifted) persons, that the proposed object itself is incompatible with the fundamental laws of the human mind. Men who would not fail to discover the fallacy of making the first principles of geometry deducible from algebra, are yet invariably mystified respecting the deductions of the first principles of mechanics, either from geometry or from algebra! We shall, however, enter into this question more at large in a future number of the *Miscellanea Mathematica*, when time and space shall enable us to resume the series.

Mr. Heather congratulates himself and his readers upon having rendered Duchayla's proof of the statical parallelogram *perfect*. We cannot, however, accord to his form of the demonstration higher commendation than to the forms it had previously assumed,—indeed, not so high as to that of Duchayla himself, (*Correspond. sur l'Ecole Polyt.*, tom. iii.,) or those of many of Duchayla's variationists, both of Cambridge and of Paris. We think, in fact, that he has misconceived the character of the geometrical treatment of incommensurability altogether; for it is not by the insertion of such magical phrases as "any whatever," that a proof adapted to commensurable magnitudes can be extended to those which are not so. Such proofs would not be admitted by any accurate geometer into the treatment of the fifth book of Euclid: why, then, should they be admitted into any of its applications? And in what sense can mp and np represent magnitudes which have not p as a common measure,—that is, in commensurable magnitudes?

It seems to us that Mr. Heather is somewhat hypercritical in his note at p. 34, upon Poisson and Pratt, as regards the enuncia-

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tion of the state of a body and the forces acting on it, which is meant by the term "equilibrium." Refinements upon language do not necessarily imply a refinement of science. He himself admits that, as far as the forces acting on solid bodies are concerned, no results follow from his view which do not also follow from the ordinary one; and we are hence led to consider, to this extent, at least, his correction as superfluous,—in truth, as a distinction without a difference. How far this view may aid the author in treating the question of the partial and total elasticity of solid bodies, and the condition of fluids enclosed in rigid vessels, we do not, of course, pretend to judge; but, for our own part, though we are fully sensible of the imperfections attached to the usual way of discussing these subjects, we are unable even to conjecture by what means Mr. Heather's views will tend to remove the difficulty. We should, indeed, be most glad to see his efforts crowned with success; and if he shall succeed, we shall be amongst the first to congratulate him on his achievement.

A few neat problems on statics are introduced into the second chapter, manifesting good judgment in their selection and good taste in their modes of solution. At the same time they include nothing which we have not seen before,—or in a very similar shape.

We must, in conclusion, refer once more to the unbecoming style in which the work has been advertised. The language employed is such as to create the most unfavourable impression upon the mind of the reader; and we have no doubt that many persons, from the self-laudation which Mr. Heather has so unadvisedly protruded on the public, will shrink from the perusal of the work altogether, just as they eschew all articles which the vendor invests with an array of "outrageous adjectives." It is a course so unusual in the really scientific world, that we fear the public estimate of his book will include the words "quack" and "puff." "Good wine needs no bush." The author of a good book, for which there is a natural demand, may always trust to the good offices of the periodical press for making its merits known, without having recourse to the questionable and unseemly practice of *himself* telling the public that it is the best of its kind. We offer him this hint with kindly intention, and we trust it will exercise a beneficial effect upon his future system of advertising.

IRON SHIPS.*

The comparative merits of iron and wood for shipbuilding have been once more brought very prominently before the public by the debate on the Navy Estimates for the current year, and some contemporaneous publications, the titles of which are given below.

Mr. Nixon's pamphlet is a very circumstantial, and, we believe, a correct statement of facts, (derived apparently from personal observation,) favourable to the employment of iron, furnished by the far-famed *Nemesis* during her arduous and splendid career in the China Seas, and the *Ariadne*, another iron steamer, which has distinguished herself on the same station—ending with a remedy for the effects of cannon shot on iron, for the sake of giving publicity to which, we rather suspect, the pamphlet has been mainly written.

The account given by Mr. Nixon of the *Nemesis*, and her performances, is altogether so interesting and instructive, that we do not hesitate to transfer it at length to our columns.

"The *Nemesis* is a name familiar to all, from the prominent part that vessel took in the late operations in China; being unquestionably the most useful in the expedition, as the narrative of her voyages and services, when under the command of the gallant Captain Hall, will clearly show, and every one who knew her well will allow. She was of 630 tons burthen, length 184 feet, beam 29 feet, depth 11 feet; and when she started,

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* "Observations on Steam Ships and the use of Iron in their Construction. By Christopher Nugent Nixon, late of the India Navy." 30 pp., 8vo.

Debate on the Navy Estimates, Feb. 26, 1846. —*Times*' Report.

"Comparative View of the relative advantages of constructing Steam Ships of Wood or of Iron, in the United States, for Ocean Navigation. By Junius Smith, LL.D."

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with 12 days' supply of coals, provisions and water for four months, with stores of all sorts for two years, and duplicate machinery—her mean draught of water was only six feet! This is a fact well deserving of notice, proving, without fear of refutation, the superior buoyancy of iron, as a wooden steamer of that size and class would have drawn more than double, under similar circumstances. Two days after leaving port, she struck on the 'Stones' at the entrance of the bay of St. Ives, and knocked a hole in her bottom; 'however, she was carried without much difficulty round the Land's End into Mount's Bay,' where she anchored, and, having procured an additional pump, by its assistance *pumped the water out* of the compartment in which the hole was, entirely repaired it on the inside, and the vessel proceeded on her voyage. This is an instance of the admirable foresight exercised in dividing the vessel into water-tight compartments or tanks; a wooden vessel would doubtless have been water-logged, and perhaps have foundered. On another occasion she struck heavily on a reef, off the point of Chuenpee, in China; but, to use Captain Hall's own words, 'her iron frame did not *hang* upon it as a wooden one would probably have done, and she proceeded without even stopping her engines. That the force of the blow, however, was considerable, and would probably have seriously damaged a wooden vessel, is shown by the fact of her having the outer paddle-ring of one of the wheels broken, together with two of the long arms attached to it. It is evident that a blow which would cause such serious injury to *iron*, would have done much more serious damage to wood.' Again, in proceeding along the upper channel towards the Macao passage, she 'struck heavily upon a sunken rock. The concussion made the vessel tremble; and had she been built of wood instead of iron, she would hardly have escaped some severe injury.'

"After the capture of Amoy, we read that, 'The *Nemesis*, in running along the shore, to avoid the swell which was setting in, unexpectedly found herself within a circular patch of coral rock, which was not visible above the surface. Several fruitless attempts were made to extricate her from this curious position, but the entrance by which she had got into it could not again be found; but her draught of water being very small, it was thought likely she would be able to force her way over the reef without suffering much damage to her iron hull, and she dashed at it at half speed. The blow, however, was more severe than was expected; the vessel bounded completely over the reef; but the sharp coral rock cut completely through her bottom, making a considerable leak in the engine-room. This was fortunately stopped from the *inside* without much difficulty, and no further notice was taken of it until some time afterwards, when she arrived at Chusan, where the damage was substantially repaired.' This is a wonderful instance of the reliance placed by Captain Hall in the invincibility, if the term may be used, of his iron favourite, although she did suffer more than was anticipated. What man is there who would have sufficient hardihood to *dash a wooden* steamer at a reef; and if such could be found, where is the *wooden* steamer that would survive it? On a subsequent occasion, when employed on important service to the southward of Chusan, the *Nemesis* 'had her false rudder carried away; and, owing in a great measure to this accident, and to the remarkable strength of the currents, as she was attempting to pass between the island of Luhwung and another small one lying off its eastern point, the current caught her bows, and threw her heavily *broadside on the rocks*. The vessel was soon got off again, but she had bilged in the starboard coalbunker. The water was pouring in fast, but it was thought that the engine-pumps would suffice to keep it under, until a good sandy beach could be found to run her ashore upon. But the water gained so fast upon the pumps, that the fire would not burn much longer, so that it was necessary to run her ashore upon the nearest beach. As the tide ebbed, the water ran out again through the leak; and then, by digging a deep hole in the sand, it was easy to get down below the ship's bottom and stop the leak from the outside.' During the night, in spite of an anticipated attack from the Chinese, 'the vessel was repaired and got off again.' Information of the accident was, however, conveyed to the admiral by the *Clio's* boat; and he immediately sent down the *Phlegethon*, with the launch of the *Cornwallis* to render assistance. By the time they arrived in the morning, the vessel was already, to their astonishment, prepared to proceed to Chusan, where she arrived in the course of the day. Here is a convincing proof of the facility and despatch with which an *iron* steamer can be repaired and rendered fit for service again; a circumstance of essential importance, especially when off an enemy's coast, where delay might be the cause of capture. Again: 'On one occasion, and without any warning, the *Nemesis* ran at full speed, and at high water, upon a dangerous conical-shaped rock, off the north-eastern extremity of Deer Island, near the southern coast of Chusan, although she had frequently been through the same

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passage before, without having discovered the danger. The tide began to fall almost immediately she struck, so that she was left with her bows high and dry, and her stern deep in the water, while she had seven fathoms close alongside of her.' It was a remarkable position for a vessel to be placed in; part of her bottom was completely clear of the rock and the water too, the vessel being only held by its extremities; and when the tide rose, every attempt to haul her off proved ineffectual. A large indentation or hollow was supposed to have been made where she rested upon the rock, which of course held her fast. By means of junks and casks 'she was, as the tide rose, fairly lifted off the rock, and launched into her own element, without having sustained any material injury.' To conclude the remarks on the durability and strength of iron steamers in general, and the *Nemesis* in particular, we may quote the following statements, made on her return to Calcutta, after her arduous services of some years in China. 'At Calcutta the *Nemesis* was docked and examined before being sent round to Bombay for a thorough repair. She was pronounced to be in a perfectly fit state to perform the voyage without risk; and she ultimately arrived safely at Bombay, under the command of Lieutenant Fell, I. N., who carried her successfully through the intricate passage between Ceylon and the main land.' At Bombay the *Nemesis* was docked; and the following extract of a letter, dated Bombay, June 19, 1843, will surprise those who are unacquainted with the durability of iron steamers: 'The *Nemesis* has been some time past in our docks, and I have carefully examined her. She displays, in no small degree, the advantages of iron. Her bottom bears the marks of having been repeatedly ashore; the plates are indented in many places, in one or two to the extent of several inches. She has evidently been in contact with sharp rocks, and one part of her keel plate is bent sharp up, in such a way that I could not believe that *cold* iron could bear; indeed, unless the iron had been extremely good, I am sure it would not have stood it without injury. Her bottom is not nearly as much corroded as I expected to have found it, and she is *as tight as a bottle.*'

"These are all convincing proofs of the *flexible* strength of iron steamers, and their being publicly known will serve to lessen, if not entirely overcome, some of the prejudices which have hitherto been current with respect to their fragility and want of buoyancy. What an awful contrast does the recent wreck of the *Atlantic*, an American steamer, offer to the foregoing statements. She is represented to have struck on a rock and 'broken in two;' and the 'sole relic of this ill-fated vessel, on the following day, was an upright beam, upon which hung a bell tolled by the sea.' Forty-five souls were drowned and killed, and thirty only escaped of the crew. The *Great Britain*, in her awkward position, has braved the fury of the elements for some considerable time, as is well known, and may eventually be got off; had she been built of wood, there would hardly be a vestige of her remaining at the present moment. But, with regard to the *Nemesis*, we may now proceed to establish her claim to seaworthy qualities. 'After leaving the Cape,' to use the language of the narrative, 'the first few days of her passage alternated between gales and calms, and the high seas which she encounted only gave a further opportunity to test the good qualities she possessed as a sea-boat. In a few days, however, she met with a severe misfortune, to which her extraordinary length and disproportionate beam exposed her, not being built, as is admitted in the narrative, as strongly as the present iron steamers are, and which could never be exposed to a similar disaster. This accident was in itself a most serious one, namely, a perpendicular crack on either side, just before the after-paddle or sponson-beam, which extended in a fearful manner towards the keel; but, in spite of this, and a succession of storms and heavy seas, and one paddle-wheel in a fractured and unserviceable state, she arrived safely at Delagoa Bay, was refitted, and ready for sea again in twenty days. There can be little doubt that a wooden vessel, in a similar position, that is broken-backed, must have inevitably foundered, and, in all probability, every soul would have been lost; for few boats could live in the boisterous seas of the Cape latitudes.'"

The case of the *Ariadne* is also powerfully corroborative of the general efficiency of iron vessels:

"The *Ariadne* was a much smaller vessel, being only 430 tons, but of rather better model than the *Nemesis*, being shorter, and with more beam in proportion; her draught of water was, at the maximum, 4 feet 10 inches, but she might be lightened, on an emergency, to about 3 feet 6 inches. On her voyage to China she was occasionally placed in trying positions; an instance or two of which may serve to corroborate the previous statements. On one occasion, in steaming out of the harbour of Abbia Amboong, in Borneo, going half-speed at the rate of seven knots, she run up on a bank of coral, where she *hung* amid-ships, there being only 3 feet 6 inches water at the

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paddle-boxes, the vessel drawing 4 feet 6 inches at the time. In this position she remained for upwards of an hour, when by lightening her she was kedged off, and pursued her way, without having received the slightest damage. At the mouth of the Yangtse-Kiang, she again struck on a sunken rock, and knocked a very considerable hole in her bottom under the engine-room: but keeping her free of water by means of a pump, in the other compartments, she was towed to Chusan by the *Sesostris*, without further accident. Had she been built of wood, nothing could have saved her. On the eastern coast of China, in consequence of the sudden fall of the tide, she got aground, and in a short time was almost high and dry, and yet by dint of great exertion, when the tide began to flow, was kedged along a rocky bottom into deep water, without being strained in the least, or having suffered any damage at all.

"Many persons would naturally suppose that iron steamers would be likely to make a considerable quantity of water, owing to the corrosion of the rivet-heads and consequent opening of the plates; indeed, some have fancied that it would be attended with imminent danger to the vessel on a long voyage. This has been proved on every occasion to be an erroneous supposition; in fact, the very reverse is the case. The *Ariadne*, as an instance, never made a drop of water, and it was a common practice, when her hold was clear of coals, to wash it out and scrub it dry on every lower deck-day, to keep the vessel cleanly and free of vermin; which by-the-by are never very plentiful in an iron vessel. She proved her qualities as a sea-boat on every occasion on which they were tested, and never once shipped a heavy sea, but rode over the waves as buoyantly as a cork. In the China Sea, when under sail, such as it was, being without fuel, she encountered a heavy gale on the verge of a typhoon, in which the barque *Ardaseer* lost her masts, and was nearly lost herself; it need hardly be said, that she weathered it bravely, and came scatheless from the encounter."

Mr. Nixon admits, however—consistently with the obvious purpose of his pamphlet—that iron vessels are much more exposed to danger from shot than those of wood. His remedy is the adoption of a lining or sheathing of the cork and caoutchouc composition, known by the name of *kamptulicon*, patented by Lieutenant Walter, R.M. The advantages claimed for this composition are, that in consequence of its elasticity it will immediately collapse after the passage of a shot, so as to prevent the entrance of water; thus *obviating the necessity for plugs.*—That it will deaden the concussion caused by the striking of shot, or in firing a vessel's own guns; thus *protecting the rivet-heads.*—That, from its buoyancy, it will keep a vessel afloat, if riddled with shot, or after striking upon rocks, and will enable her to carry *a large supply of coals with a smaller draught of water.*—And that it will prevent the *loss of life caused by splinters*, by their retention in the material.

Mr. Nixon bears the following personal testimony to the value of the *kamptulicon:*

"To the truth of most of these assertions I can bear ample testimony, having witnessed the experiment at Woolwich on the 4th of September last, the object of which was principally to test the practicability of its adhesion to the iron, *without the use of bolt or bar of any kind;* four previous experiments having, it was stated, given great satisfaction in other respects. A target of iron, six feet square, to which the *kamptulicon* lining was attached by means of a solution prepared for the purpose, was erected at a distance of 40 yards from a 32-pounder. Four shots were fired, with the iron surface presented, with very curious effect; two of which deserve especial notice; viz., the third, which, fired with a reduced charge, to represent a long range, lodged in the material; and the fourth, which, with still further reduced charge, fell, without doing injury, at the base of the target. It was then turned round, with the *kamptulicon* lining towards the gun, at which four shots were also fired. The first two passed through with nearly the same effect, opening out the iron to a considerable extent, but the lining closed up immediately, so as scarcely to admit the insertion of a small cane at either end, the centre being quite close. The fourth shot, fired with a very reduced charge, *rebounded* about *fifteen yards* in a direct line; thus proving that a shot at a *long range* would not even *enter* a vessel so *lined*. It may also be presumed, from the wonderful resistance of the material, and its repellant power, that nothing under a *full charge would fire a shot through the two sides*. As to its adhesive nature, it need only be said that it occupied a dozen strong men, armed with handspikes and crowbars, a considerable time, to detach it from the iron after all this battering. In small portions cut from the different targets may be seen large pieces of iron imbedded, which

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might cause frightful wounds, and even death, if scattered among a crew."

It may be inferred, however, from some statements of indisputable authenticity, made in the course of the late House of Commons' debate, that the danger from shot is far from being anything like what Mr. Nixon would have the world believe, or, indeed, more than may be readily provided against, even without the help of the *kamptulicon*. First, there is the following letter from Captain Hall, of the *Nemesis*, himself:

" The *Nemesis* was frequently struck, as often as 14 times in one action, and much damaged by shot in her upper works; but only one shot can be said to have gone straight through the vessel, which made a hole as if you had put your finger through a piece of paper. Other shots struck the *Nemesis* in a slanting direction, and merely indented the iron, glancing off without penetrating. We remarked no particular danger from splinters of iron, but I would observe that the *Nemesis* was constructed of the best possible material, and put together with the best possible workmanship. She was also divided into seven watertight compartments; and I am of decided opinion that no war-steamer of iron should be divided into less. The *Nemesis* had holes knocked in her bottom many times by sharp rocks, but those were easily stopped for the time by driving in plugs of wood and oakum from the inside. For myself, judging from my own experience, and well knowing that the sides of iron steamers (particularly between wind and water) could be strengthened and supported so as to prevent the destructive effects of shot, which have caused so much alarm, I should still give the preference to an iron over a wooden steamer as a command under all circumstances."

Still more to the point is a letter from Captain Charlwood, of the English navy, and late commander of the Mexican frigate *Guadaloupe*.

" Notwithstanding the extraordinary report which had been sent home of the effects of shot upon one of our iron men-of-war, my opinion is as strong as ever upon this subject, providing the vessel is properly built, and I should still certainly prefer commanding an iron steam frigate to a wooden one. I think also that you will consider my opinion as to the effects of shot upon iron vessels is not a rash one, or made upon slight grounds, when I inform you of the following particular cases which occurred to the *Guadaloupe* Mexican steam frigate, two of which occurred when I was actually on board in command of the vessel, and the others very shortly after the Admiralty order reached me instructing me to return home, when Mr. Martin, a relative of mine, was in command. Full particulars of each case I have both from him and other officers who were on board:—1. A 24 lb. shot struck the vessel on the bow, at the point where the woodwork of the head is bolted on the bow, and consequently lies on the iron side. This shot, fired from a distance of about 1000 yards, passed through the woodwork, say about five inches thick, and the iron, and dropped on board, simply making a hole sufficiently large to let the shot pass through. 2. A shot struck the counter, indented the iron, and glanced off; had the vessel been constructed of wood, this shot, I think, would have entered. 3. A 24 lb. shot, nearly spent, struck the iron bulwark on the inside, having passed over the port side of the vessel; this shot starred the iron and burst the rivets of a plate for about nine inches in length. 4. A full plumper 24 lb. shot struck just abaft the mainmast, on the port side, and about two feet under water; this shot passed through the side, and lodged in the coal bunker; the hole was made quite tight temporarily with a common plug; no rivets were started, or damage done, beyond the circular hole made by the shot. 5. An 18 lb. shot fired at a distance of about 200 yards: this shot struck the vessel's side near the foremast, passed through the iron, making as clean a hole as if it had been drilled, and through three casks of salt provisions. These shot holes were all repaired by the boiler-makers, who served on board as engineers and firemen. Four holes were drilled round each shot hole from the inside, corresponding with four holes in an iron plate, which was lowered down on the outside, and four screw-bolts made them perfectly tight and secure, not a drop of water finding its way through; the vessel was in severe weather repeatedly afterwards, and I believe that to this day nothing more has been done to these shot holes. I should remark that the case No. 3, of the spent shot, would have been the worst leak to contend with, had it struck the vessel under water, as a plug could not easily have been applied; but still the leak would not have been comparatively a severe one. Several other shots struck the vessel about the hull, both when I was on board and afterwards, but these are the only cases worth mentioning, and which have any bearing upon the question in point."

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The author of the last publication on our list is Dr. Junius Smith, an American gentleman lately resident in London, and not unknown to our scientific circles. His essay will be found entire in another part of our present number. Dr. Smith is all for wood against iron, and supports his position in a style of no small philosophical pretensions, though in truth he has brought nothing new to bear upon the points disputed, either in the way of fact or speculation. Of the late outcry against iron, on account of the supposed danger from shot, he makes a great handle; but after the statements of Captains Hall and Charlwood, what Dr. Smith says on this head, particularly as to plugging up the holes, may be set down as simply ridiculous. He dwells, also, much on the liability of iron to corrosion; as if there were not some dozen, at least, well-known means by which this may be guarded against. One very good remedy is pointed out by Captain Hall: "The corrosion of the bottom can be prevented to a great extent by constantly painting it with red lead,—an operation which is much facilitated by the ease and safety with which a flat-bottomed iron vessel can be laid ashore." The only point that Dr. Smith makes good is one which is strictly limited in it application to countries such as the United States, where ship timber is to be had in abundance,—namely, the superior cheapness of wood as compared with iron. But, for the converse of the same reason that wood may be preferable in the United States, is iron the better material for an iron country like our own. The argument on this head cannot be put in fewer or better words than those used in the late debate by Mr. Corry, the late Secretary of the Admiralty: "By far the largest portion of the timber used in the construction of ships is of foreign growth; and it is therefore a material point if iron, which is easily procured in this country, can be safely applied to the building of ships of war; and secondly, if there were a sudden demand for an increase of our naval force, as there was when the well-known 'Forty Thieves' were built at once, it would be totally impossible either in our public dockyards or in the shipyards of private builders to find a sufficient quantity of seasoned timber, and the necessary consequence would be a premature decay of those built of timber unfit for use."

COMPARATIVE VIEW OF THE RELATIVE ADVANTAGES OF CONSTRUCTING STEAM SHIPS OF WOOD OR OF IRON, IN THE UNITED STATES, FOR OCEAN NAVIGATION. BY JUNIUS SMITH, LL.D.

From the natural position of the United States, and the peculiar characteristics of the people, the science of marine architecture, by an inevitable consequence, claims a prominent rank in the pursuits of knowledge; and being so closely interwoven with all the great interests of the country, its cultivation and practical application will continue to be, what it ever has been, a subject of the deepest solicitude. Whether we consider it in relation to the mercantile or the naval marine of the country, it is equally important. The experience of all time is before us, and it remains to be seen how far the genius of the people will discover improvements, and add strength, beauty, velocity and durability to the naval and mercantile force of the country.

The introduction of steam as a propelling power, and its gradual but uninterrupted extension, open a new field for scientific labour, and stimulate the public mind to bold and untried achievements. That there should arise amidst the developments of sanguine minds much fancy and speculation, and theory and costly experiments, upon a theme so new and comprehensive, is just what might be expected. But even the failure of the most flattering anticipations, advances the science itself. Our ideas are corrected, by being driven from untenable positions to others more sound and practical. The best system is ascertained by experiment, and by experiment only. In this respect it bears some analogy to the science of chemistry, which has grown up, step by step, by slow but certain advances, until the elementary principles are more fully developed, and their application to the arts, and to manufactures, has conferred incalculable benefits upon the family of man. It is worthy of remark, that the fact of several iron steam ships having been constructed in England, is no ground for concluding, even supposing they succeeded, that it will be equally advantageous to build of iron in the United States. In England iron is cheap and timber dear. In this country timber is cheap, and iron dear. The first

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cost of a ship therefore depends not upon the material itself, with which it is constructed, but upon the price and facility of obtaining that material at the place of building. In this country, the cost of an iron-built ship is about 30 per cent. more than the cost of a wooden-built ship of the same dimensions. She ought, therefore, in order, to stand upon an equally advantageous footing, in reference to the expense of construction with a wooden-built ship, to be kept in repair in a sea-worthy condition, at 30 per cent. less expense, and to maintain a durability of 30 per cent. longer time than a wooden-built ship. A short time has elapsed since the first construction of iron steamers for ocean navigation, and so far, the result of experiment is by no means in favour of their durability, compared with timber-built ships.

The *Montezuma*, a Mexican iron steamer, constructed at Woodside, opposite Liverpool, in England, was sent to New York, together with the *Guadaloupe*, two years ago, for repairs. The *Montezuma* had been in service about three years. When in the hydraulic dry dock, I went to examine her condition. I found that between wind and water, there was a streak from stem to stern, where corrosion had taken effect; and the whole line was eaten in, from 1-16th to 1-8th of an inch, resembling a honey-comb. The cause of this effect is sufficiently obvious. The motion of the ship at sea, alternately dipping and immerging, and bringing the salt water under the action of the hot sun, produces a chemical decomposition of the liquor, evaporating the fresh water particles, and concentrating the muriatic acid; and thus forming a powerful solvent, constantly acting upon the iron plates. It may further be observed, that iron has a strong affinity for muriatic acid, which rapidly dissolves thin sheets of iron with which it comes in contact, and is forced by attraction and pressure into the cavities of the iron, expelling the globules of air and assuming their place, and thus breaking the strength of the iron just in proportion as the attraction of aggregation is overcome.

If so great an effect be produced in three years by the action of salt water upon the iron plates, and the remaining plates weakened in manner and measure similar to the dry rot in timber, the understanding can find no great difficulty in measuring with tolerable accuracy the *durability* of the ship. It will be borne in mind, that the last stage of consumption is far more rapid than the first, because the disease has penetrated the whole mass, its constitutional vigour is prostrated, and the living thing is already dead.

I am aware that a new mode of galvanizing sheet iron has been brought before the public, and that high expectations of thus rendering it anti-corrosive are indulged. Undoubtedly it will check oxidation upon the body of the plate, but, beautiful as the operation is, I fear the grand difficulty will remain unremedied. Wherever a hole is perforated for rivets, or screws, or bolts, there the iron plate is already weakened in exact proportion to the number and size of the holes. The muriatic acid is invited, and it begins to feed upon and oxidate the whole ship. There is a mutual attachment, and they rush into each other's arms, though a space not larger than a hair.

Another important result from the experiments that have been made, demands our notice; and that is, the impossibility of rendering a ship constructed of iron plates, riveted together from two to three hundred feet in length, as the case may be, waterproof. The rivets which fasten the iron plates to each other, or to the iron ribs of the ship, are the bearings which are to sustain the warping and straining of the ship at sea. By continual action, there being no elastic medium between the joinings of the plates, a gradual, though minute opening, sufficient for the admission of water is made throughout the ship, and I apprehend this much to be the case if there were no other wearing by the motion of the ship than that upon the rivets. The drawing of the head of a rivet, a screw, or a bolt through a plate, which I have seen, causes a leak not easily detected, and still less easily remedied. This fact, I believe, will be confirmed by the experience of all the iron steamers that have weathered the ocean.

The *United States* revenue iron cutter, the *Legare*, which I examined when under repairs, last year in New York, is a very leaky ship. The openings of her plates, at the bottom of her keel, were, at least, half an inch, and they extended, more or less, from stem to stern, between each set of plates. Workmen were employed in forcing lead into the openings to stop the leaks, a process which, it appeared to me, would ultimately make the leaks worse than before. A ship constructed of timber is caulked between every streak of planking, from the keel to the upper deck. The aggregate of this caulking, thus distributed, constitutes an elastic body of considerable thickness, which yields imperceptibly to the heaving and rolling of the ship, without opening a seam or admitting water. In case of a leak, the ship is easily fresh caulked, and all necessary repairs made with great facility. But you cannot caulk an iron-built ship;

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and from my own observation, I perceive that oxidation of the iron plates, both within and without the ship, commences the moment they come in contact with salt water; and of course the chemical laboratory is at work to effect leakages, and the ultimate consumption of the ship. The repairs of an iron-built ship are far more difficult, and expensive, and ineffectual, than the repairs of a timber-built ship. Few people can work in iron -- almost every sailor can work up wood. The idea suggested by an honourable senator, that iron ships require no repairs, and will last almost for ever, is entirely fallacious, and founded upon mistaken data, or the want of experience.

The formation of lamina, or thin scales upon sheet iron when exposed to the action of salt water, is a natural consequence, and becomes visible, more particularly after having been fresh painted. The oil of the paint loosens the oxidated scale, so that it peels off, leaving its original place upon the plate untouched by the paint, and ready for the repeated action of the muriatic acid. This is generally visible in a few hours after painting. The abstraction of every scale, it is easy to see, is a diminution of the strength of the ship.

The effect of temperature in the expansion and dilatation of all bodies is a universal law of nature, and worthy of our consideration in the present inquiry. The same amount of heat has not the same effect on all bodies, inasmuch as liquids expand more than metals, and air form bodies more than either, and under the application of the same quantity of caloric. By the introduction of an intermediate body, that of quicksilver, the only metal that retains a fluid state at the atmospheric temperature, and confining it in a convenient instrument, known as a thermometer, and making that a general standard, we can graduate the relative quantity of caloric in any body, and, of consequence, measure the expansion and contraction of metals when exposed to different degrees of heat and cold, with sufficient accuracy to enable us to lay hold of important results in reference to iron-built ships. By the attraction of aggregation, the particles of metals are held together in what is called a solid state, although, philosophically speaking, there is no solidity about it. These particles approximate with infinite nearness, and yet never touch one another. The cavities of the metal are filled with innumerable globules of air, and the application of heat expanding the air, drives the metallic particles asunder in proportion nearly to the quantity of heat applied; so that if the heat be raised to a very high temperature, the hardest steel that was ever manufactured may, under the action of a blow pipe, be reduced to an impalpable powder, lighter than the atmospheric air, and will float in that medium like the small dust of the balance in the beams of a summer's sun.

But our immediate object is with iron only, and to inquire how far the general law of expansion and contraction bears upon the matter in hand. It may, however, be observed, that the expansion of metals is not in exact proportion to the movements of heat applied. The strength of cohesion is weakened by every addition of heat, and, of consequence, a less quantity is necessary to overcome less resistance, and, therefore, the same quantity added to high temperature would occasion a greater expansion than the same quantity added to a low temperature. In view of this great and fundamental law of nature, I sometimes fancy in the morning that I hold the mercy of Jehovah in my hand, in the form of a razor. The application of heat only would at once reduce it to a liquid or aëriform state in the very act of shaving. It would drop like water at my feet, or dance away upon the breeze.

A few years ago Dr. Ure, the author of a valuable dictionary upon practical chemistry, then in London, sent a message desiring to see me. I found him engaged in experimental philosophy, and perfecting a very ingenious steam valve, which acted altogether upon the principle of expansion and contraction. The expansion of the metallic arm, connected with the valve by the heat of the boiler, opened the valve in proportion to the degree of heat, and the refrigeration of the heat again closed it, so that the quantity of steam allowed to escape the safety valve depended entirely upon the temperature of the heat. I have no means at hand of ascertaining exactly what would be the expansion of an iron-built ship, 300 feet long, for the addition of every 20° of heat, nor do I deem it necessary in the present inquiry; seeing the contraction under an equal degree of cold is equal to the expansion under a similar degree of heat, we can easily perceive that every particle of matter in an iron-built ship is in ceaseless motion. The ship is all alive, a sea-serpent, a mighty snake, expanding and compressing its elastic folds at the bidding of an unconquerable and ever-active agent.

Iron Steam Ships of War.

On this point we have no experience. The merchant marine affords but limited and unsatisfactory results. The iron steam-ships of war recently constructed in Great

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Britain have not had time to demonstrate their properties and present us with experimental facts. We are thrown, therefore, upon the resources of the mind, and to the necessity of feeling our way to the most important purposes to which marine architecture can be directed.

The objections already suggested in regard to the *cost, durability, water proof, and expense of repairs* of the mercantile iron-steam-ship marine, are common to all iron-built ships. But with respect to ships of war, there are other objections, arising from the peculiar nature of their employment. A shot will penetrate the side of an iron-built ship as well as of one built of wood. In that event, the first thing that occurs to the mind is the difficulty of stopping the hole. A wooden plug is effectual in stopping a hole made by a shot penetrating the side of a wooden-built ship; but in consequence of the shaggy nature of an orifice made through an iron plate, it is quite impossible to exclude the water by a wooden plug. The opening may be partially stopped, but in action no time can be allowed to file away the indentations of the orifice and fit it to receive a plug, and a number of such openings would still admit sufficient water to flood and endanger the ship.

Whether the fragments of an iron sheet, carried into the ship by the force of the ball, would be more destructive than the splinters of a wooden plank, is a question which cannot be determined by any evidence of which I am aware; but it seems reasonable to suppose that the difference would be just that observable between an iron and a wooden ball. The iron fragments detached from a plate would be nothing less than a volley of shot sweeping through the ship, and doing more execution upon the crew than the shot itself.

Anything like forcing in a considerable portion of the side of an iron-built ship, would, I apprehend, be certain destruction, as no adequate means of repair could be had at sea. The ordinary means of repairing a wooden-built ship under such circumstances would utterly fail, and she must be left to the mighty ingushing of waters that would soon engulph her. In the present state of marine architectural science, it would seem, upon this brief view of the subject, that the risk is too imminent, the expense too large, the durability of the ship too uncertain, and the advantages too problematical, to justify a departure from the established mode of constructing steam ships of war in the United States.

Since the foregoing remarks were written, the steamer *Britannia* has brought to our aid, and in confirmation of the conclusion to which we had come, most important information, under the head of Portsmouth, August 14th:

"Some remarkable results have been produced by the experimental shot practice from the *Excellent* on the iron steamer *Ruby*, and it is expected the Admiralty will, in consequence, stop the building of iron and other vessels for the present. The shots which hit the *Ruby* not only penetrated the side first struck, but in some instances passed through the other side, carrying with it whole plates of iron. In action, this would risk the total loss of the vessel, for on heeling over to leeward, such a body of water must rush in, that nothing would prevent her sinking with all on board.

"A representation of this important circumstance, arising from the recent trials, has been made to the Admiralty; and should further experimental firing prove that serious risk will be occasioned to iron vessels of war when exposed to the chance of being struck by heavy shot, it is doubtful if the Board will not abolish them as men-of-war."

From the fact that the result of these experiments was reported to the Admiralty, we may infer that they were made by its orders; and from the plain, straight-forward details presented to the public, there does not appear any ground to doubt their correctness. If they do not go far enough entirely to settle the question, they do go far enough to settle the impolicy of building iron steam ships of war, with a weight of evidence so preponderating against their utility.—*American Democratic Review.*

THE NEW TRANS-URANIAN PLANET—NEPTUNE.

While M. Arago insists on giving to this New Planet the name of his countryman Le Verrier, its pseudo-discoverer, nearly all the rest of the astronomical world seem agreed in thinking *Neptune* a more appropriate name. M. Struve, on the part of the Petersburgh Academy of Sciences, assigns the following reasons for the preference, (we quote from the *Athenæum's* translation of M. Struve's letter):

"1. The name of *Neptune* was first suggested by the *Bureau des Longitudes*,—and has been adopted since by various astronomers. We join with the majority of eminent geometricians and astronomers in France, assembled in the body in question, in attaching greater importance to such a selection than to the different and individual opinion of a *savant*, however justly celebrated.

"2. We do not deny to the discoverer of a planet either his right of proposition or his just pretensions to have his proposition accepted. Nevertheless, history teaches us that the name proposed by the author of a discovery does not always maintain its ground. Herschel, as a mark of gratitude to

his royal patron, named his planet *Georgium Sidus* or *Georgian*. This denomination gave way to that of *Uranus* proposed by Bode. If the name *Georgian* be yet found in the 'Nautical Almanac,' on the other hand Sir John Herschel, the son, adopts in his writings the name of *Uranus*.

"3. It has already happened, before now, that an astronomer having discovered a planet, has ceded his right of denomination to another. When Olbers found his second planet, he called upon that *savant* who had contributed most largely to the rapid progress of the theory of the movement of the new planet to give him a name for it. M. Gauss chose the name of *Vesta;* which has since been adopted. Let us observe, however, that any proposition for a name coming from a substitute is less obligatory than if it came directly from the discoverer himself.

"4. The name chosen by M. Arago is liable to two objections—

"*a.* All the planets hitherto known are called after the divinities of the Greco-Roman mythology. To the names of the gods in use since ancient times have been added, since 1781, the names Uranus, Ceres, Pallas, Juno, Vesta and Astræa. Neptune ranges perfectly in this series: while the other name proposed contrasts with it—being against analogy and against the custom as adopted in the naming of six successive planets. The idea of transferring the name of the discoverer to the planet is not a new one. The attempt has been made—but unsuccessfully. Consequently, history has determined in favour of the names of the gods. Why, then, resist, the decision of history?—and why, above all, in the present instance of a discovery made under circumstances entirely peculiar?

"*b.* Far be it from us to have any attention of withholding our entire admiration from the eminent merit of M. Le Verrier. But impartial history will, in the future, make honourable mention also of the name of Mr. Adams,—and recognise two individuals as having, independently of one another, discovered the planet beyond *Uranus*. In the same way, it attributes the discovery of the infinitesimal calculus at once to Newton and to Leibnitz. Mr. Airy, the Astronomer Royal at Greenwich, has published a complete and authentic report on the labours of Mr. Adams relative to the existence of the Trans-Uranian planet. In that report, we see that in September 1845, Mr. Adams arrived at a result, and that in October he transmitted to Mr. Airy a paper containing elements of the present planet so nearly approximative that it might have been found in the heavens ten months before it actually was. But, Mr. Adams's labours were unsuccessful because the two astronomers (Mr. Challis of Cambridge and Mr. Airy of Greenwich) to whom they were known hesitated to admit them without further examination. Their doubts are explained by the importance and novelty of the object, and by the extraordinary difficulty of the research itself—which might well have been deemed beyond the powers of a young *savant* till then unknown. These doubts were, accordingly, not dissipated until the moment when M. Le Verrier published the results of his admirable investigations, which led to the most brilliant discovery in the astronomy of the solar system, while the other astronomers of Europe had no suspicion of the existence of Mr. Adams's labours. M. Galle, of Berlin, was the first to find the planet indicated by M. Le Verrier. While we consider all these circumstances attendant on the discovery of the new planet,—we at the same time conceive that we find the adhesion of M. Le Verrier to the name of *Neptune* not only in his announcement to us of the 1st of October, but also in his later letters addressed to the Academy of Sciences and to two astronomers of the central Observatory—letters which make no objection whatever to the name of *Neptune* chosen by the *Bureau des Longitudes*. Consequently, we will retain the name of *Neptune;* and will make no change, unless hereafter the general voice shall determine in favour of another name."

Professor Airy has announced his adhesion to the conclusion of the Petersburgh Academy, and states that Gauss and Encke have also decided on retaining the name of Neptune.

Mr. Airy objects, however, to one important part of the translation given by the *Athenæum* of M. Struve's letter. He says, (*Athenæum*, Feb. 27th,)—

"The sentence in which M. Struve introduces the name of Mr. Adams in the original, runs as follows:—'Mais l'histoire impartiale, dans l'avenir, citera honorablement *et à côté* de M. Le Verrier aussi le nom de M. Adams, et reconnaitra deux individus qui ont découvert, l'un indépendamment de l'autre, la planète au-delà d'*Uranus*.' Your translation omits the words 'et à côté de M. Le Verrier.' This expression—literally rendered 'and by the side of M. Le Verrier'—will, I apprehend, be correctly translated by the figurative expression more commonly used in English 'and in the same rank with M. Le Verrier;'—not necessarily implying, as I conceive, either that the writer judges the merit of the two discoverers to be exactly equal, or that he has any distinct opinion as to which is the superior. The whole sentence, therefore, will be translated nearly as follows:—'But impartial history will, in the future, mention honourably and in the same rank with M. Le Verrier the name of Mr. Adams also; and will recognise two individuals as having, independently of one another, discovered the planet beyond *Uranus*.'"

It is true the words "*et à côté* de M. Le Verrier" have been overlooked in the translation of the *Athenæum*, but as little have they their counterpart in Mr. Airy's "*in the same rank* with M. Le Verrier. It is not a translation, but a *rank* falsification, only to be accounted for by the repugnance which the Astronomer Royal has shown all through to render full justice to Mr. Adams. The phrase "*à côté de*," as used by M. Struve, has manifestly a special reference to the position in which the two parties stand with respect to the discovery of the new planet, without any reference whatever to their "rank" as astronomers. Literally translated, it means "by the side of," but would not perhaps be less truly rendered by our more common and pithy phrase of "side by side." Mr. Airy's objection is the more pettishly absurd, that he had himself, in a previous letter (18th Feb.) to the *Athenæum*, used the words, "I agree with M. Struve, that future history will place the name of Mr. Adams *by the side* of that of M. Le Verrier."*

* We may take this opportunity of noticing an error of the press which somewhat disfigured the unanswered and unanswerable letter of our correspondent "Exoniensis," on the subject of the rival claims of Adams and Le Verrier. *Mech. Mag.*, Dec. 26, 1846. The article was headed as referring to the new planet "Astræa." No mistake of "Exoniensis" this, (as may readily be supposed,) whose manuscript was without any heading at all; but the mistake of a friend to whom the superintendence of the article through the press was intrusted.—Ed. M. M.

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AMERICAN ENGINEERS IN RUSSIA.

The *Philadelphia Inquirer* gives the following extract of a letter dated "Head Mechanical Works, Alexanderoffsky, St. Petersburgh, Russia, Nov. 4, 1846:"

"In the beginning of our operations here, we had much, very much to do, in organizing this mammoth establishment. We found it greatly in decay and confusion, so much so, that we abandoned all the old tools, and fitted up the establishment anew. We were looked upon by many as wild adventurers, and that we had undertaken to do a vast deal more work than it was possible to do in the time allotted; but at the expiration of our second year, we became convinced 'that some things could be done as well as others,' and at the present time it was only requisite for us to say a thing can be done, and all hands knock under, we shall finish this year or the beginning of the next, the full complement of trucks, (5300,) and in all of next year, (1847,) the 162 locomotives will be finished. We are now driving on with such speed, that we feel no hesitation in duplicating our first order by 1850. We have limited the number of engines to be turned out six a month, to prevent running out of materials. We have turned out nine in a month, and the number for the last ten months is 65—the full number now finished is 85. In our car shops we are getting on finely; we have delivered to the Government 200 platform cars, and 300 box, and are finishing 5 box cars daily—they are 8 wheel cars, 30 feet long. We have not yet commenced on the passengers' cars, but have completed the building of a shop for that purpose. The building is 375 feet long by 60 wide, and divided into three apartments — the first for preparing the work, the second for erecting, and the third for painting. The number of cars that we have to make are 2000 box, 580 platform, and 70 passengers' cars—making the complement for the 5300 trucks in the first order. Independently of these, we have taken an order for two Imperial cars, 70 feet long, to be placed on 16 wheels. We are to receive for these cars —— rubles of silver each, or 8625 dols., without chairs, sofas, or inside trimming. We have undertaken, and now have nearly completed, about 20 miles of railroad. This we undertook more for our accommodation than profit, so as to have a portion of the road to operate upon. We have declined making the rest of the road, as it would interfere with our present business. We do considerable transient work, and could have much more if we choose to do it. We are now making seven stationary engines for the interior, and have in hand several heavy orders for bolts and nuts for bridges on the line. This has been a very busy year for me, and our imports have been very heavy, amounting to over half a million of dollars. The number of vessels we have received this year is 85, and there are several more yet to arrive. We have had at a time, this summer, nearly 3000 men employed, which, together with the foreign business, has given the mercantile department much to do, and to prevent errors occurring, I have been constantly on the alert. All the business with the government has to be transacted by writing."

PAPAL MOSAIC MANUFACTORY.

No change appears to have taken place in the mode of manufacture followed here during the last 200 years. A plate, generally of metal, of the size of the picture to be copied, is first surrounded by a margin about $\frac{3}{4}$ of an inch from its surface. This is then covered over with a coating of perhaps $\frac{1}{4}$ of an inch in thickness of mastic cement—composed of powdered Travertine stone, lime, and linseed oil. This is, when set, entirely covered with plaster of Paris, rising to a level with the surrounding margin, which is intended to be exactly that of the finished mosaic. On this is traced a very careful outline of the picture to be copied, and, with a fine chisel, just as much is removed from time to time, as will admit of the insertion of the little pieces of glass mosaic, or, as the Italians call it, "smalto." This smalto is composed of glass, and is made in rounds, about six or eight inches in diameter, and $\frac{1}{2}$ an inch thick. The workmen then proceeds to select from the great depository, wherein are preserved, in trays, nearly 10,000 varieties of colour, those he may require, which he then works to the necessary shape. This is done by striking the smalto with a sharp-edged hammer, directly over a similar edge, placed vertically beneath. The concussion breaks the smalto to very nearly the shape required, and it is then more perfectly ground, by application to a lead-wheel covered with emery powder. The piece thus shaped is then moistened with a little cement, and bedded in its proper situation; and so on, until the picture is finished: when the whole is ground down to an even face, and polished. Six regularly instructed artists are now constantly employed in the Fabrica, at the Vatican. The Florentine mosaic, instead of being composed of a fictile material, is made entirely of marbles, agates, gems, &c., and by means of these materials only, graceful and elaborate representations of flowers, fruit, ornaments, &c., have been produced. Marbles and jaspers of brilliant

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colours, being, of course, very valuable, are only used in thin slices, like veneer; and are backed upon slate. The process is extremely tedious, a paper mould having to be cut for every small piece of marble, and each part must be ground at the wheel until it exactly coincides with that pattern. Considering the extreme difficulty of working in such materials, the finished pictures are quite astonishing, and some of the works at present in hand in the Grand Ducal manufactory at Florence, intended for the high altar in the chapel of the Medici at San Lorenzo, will be the most beautiful specimens yet produced. Of course, the demand for such elaborate, and consequently expensive labours, must be very limited; so that the trade cannot be general.—*Wyatt "On the Art of Mosaic."*

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 214.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

Roger Pickering, of Muswell, otherwise Mousewell Hill, Clerkenwell, and minister of the word of God, and one of the fellows of the Royal Society: for a method of producing British spirit from materials of British production. Cl. R., 22 Geo. 2, p. 3, No. 14. March 16 last; July 15, 1748.

John Baker, of Bakewell, (Derby,) whitner and hosier: for an invention, (being in the form of and answering the end of pot ashes and pearl ashes,) from the common gross lees that are produced after the boiling, bouking, or bucking of linens and cottons, of making the same again serviceable and fully effectual in the boiling, &c., of linens, &c., and likewise in making soap, and in every other manufactory wherein pot ashes or any other vegetable ashes are used. Cl. R., 23 Geo. 2, p. 6, No. 9. April 3, 22 Geo. 2; Aug. 1, 23 Geo. 2, 1749.

William Sedgwicke, of Newcastle-on-Tyne, surgeon: for a method of making a drug called sal ammoniac, or armoniac, of greater purity than any hitherto imported from foreign parts. Cl. R., 22 Geo. 2, p. 13, No. 15. Feb. 23, 22 Geo. 2; May 3, 22 Geo. 2, 1749.

Henry Watson, of Bakewell, (Derby,) stonecutter and carver: for cutting or sawing marble, or any other stone, for sweeping or facing, and also polishing the same by a new invented machine or engine, of great advantage to his Majesty's subjects by supplying them with marble and stone for stables, chimney pieces, paving, and for all other purposes wherein stone or marble is used. Cl. R., 25 Geo. 2, p. 13, No. 8. Oct. 11, 25 Geo. 2; Dec. 3, 25 Geo. 2, 1751.

John Baker, of Manchester: for an art or method of making oil of tar and lampblack. Cl. R., 27 Geo. 2, p. 12, No. 13. Jan. 13, 26 Geo. 2; March 26, 1753, 26 Geo. 2.

Joseph Bosley, of Leadenhall-street, London, watchmaker: for a new invented movement of repeating watches, and all other sorts of watches, on a new principle never heretofore used, which gives a much lighter and kinder friction all through the work, carries a greater power to the balance, goes much more regular, lasts longer without repair, and costs but little more money than repeating or other watches made on any principle heretofore used; and also a new invented slide to watches, which is more intelligible and certain to regulate watches by. Cl. R., 29 Geo. 2, p. 4, No. 15. March 1, 28 Geo. 2; June 21, 28 Geo. 2, 1755.

Thomas Clark, late of Edinburgh, shoemaker: for tobacco and snuff boxes, inkholders, pen cases, and spectacle cases, all made of leather in a manner newly invented. Cl. R., 30 Geo. 2, p. 6, No. 13. March 3, 29 Geo. 2; May 28, 1756.

James Collier, esq., of Lincoln's-Inn: for an engine or mill for draining waters from fenny, marsh, and drowned lands, which will raise and discharge the waters in much greater quantities, and with more use and certainty than any other mills or engines which have hitherto been made use of for that purpose [wind machine.] Cl. R., 30 Geo. 2, p. 9, No. 17. Sept. 10, 29 Geo. 2; January 9, 1756.

Henry Raminger, of the parish of Christchurch, (Surrey:) for shot commonly used for fowling, and bullets of lead, (made by machines invented by the specifier,) more exactly round and solid, and to much greater perfection than hitherto practised. Cl. R., 32 Geo. 2, p. 4, No. 19. June 29, 1758; Sept. 23, 1758.

Christopher Irwin, of Suffolk-street, St. Martin-in-the-Fields: for a new invented marine observatory, and new adapted telescope and almanack, by which the longitude at sea may be ascertained in a far more plain, easy and exact manner than has hitherto been discovered, and be in several other respects useful in navigation. Cl. R., 33 Geo. 2, p. 2, No. 19. Dec. 2, 32 Geo. 2; March 14, 1759.

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Christopher Lebrecht Chrysel, of Saint Luke, (Middlesex,) chemist: for an invention of taking off wool from sheep skins preferable to that now practised by rotting and lime. Cl. R., 33 Geo. 2, p. 2, No. 8. January 24, 32 Geo. 2; May 19, 32 Geo. 2; 1759.

Richard Tredwell, of Saint Giles-in-the-Fields, (Middlesex,) coach spring maker: for new invented ribbed springs for hanging of coaches, and all other carriages upon. Cl. R., 33 Geo. 2, p. 2, No. 6. Feb. 21, 32 Geo. 2; April 20, 1759.

John Mackay, of the parish of Saint Andrew, Holborn, (Middlesex,) esq., pursuant to patent granted to the said *John Mackay* and *Jonathan Greenall*, of Parr, (Lancaster,) engineer: for a new method of manufacturing salt. Cl. R., 1 Geo. 3, p. 3, No. 18. Feb. 6, 1 Geo. 3; May 9, 1761.

George Dundas, of Banbury, (Oxford,) whip maker: for a new invented engine or machine for platting or weaving of whips. Cl. R., 1 Geo. 3, p. 10, No. 19. August 3, 1 Geo. 3; Nov. 4, 1761.

Richard Tredwell, of the parish of Saint Giles-in-the-Fields (Middlesex), coach spring maker: for a curious new iron machine for moulding and setting all kinds of springs for hanging of coaches and other carriages upon. Cl. R., 2 Geo. 3, p. 2, No. 3. Feb. 10, 2 Geo. 3, 1762; June 7, 1762.

Richard Tredwell, of Saint Giles, (Middlesex,) coach-spring maker, and *Thomas Overton*, of Hart-street, Bloomsbury, ironmonger: for new invented springs for hanging coaches and other carriages upon, which is so constructed as not to be liable to give way or break, &c., &c. Cl. R, 2 Geo. 3, p. 2, No. 2. Feb. 10, 2 Geo. 3, 1762; June 9, 1762.

Sampson Swaine, of Cambron, (Cornwall,) smelter and refiner: for a new method of constructing and adapting to each other a machine, furnace, and fire engine so that the same fire shall at the same time be capable of smelting and refining several sorts of metals, and working a fire [steam] engine to raise water, and stamp ores, and serve many other useful purposes. Cl. R., 2 Geo. 3, p. 3, No. 19. May 21, 1762; July 24, 2 Geo. 3, 1762.

James Edgell, of Froome Selwood, (Somerset,) gent.: for a new belt or girdle called a Shooting Belt which charges, to be worn over one shoulder, so contrived that all persons shooting with small shot may with ease to themselves carry therein a much larger quantity of gunpowder and shot than in the usual manner, and so contrived as to be particularly useful in expeditiously charging. Cl. R., 2 Geo. 3, p. 3, No. 17. June 8, 1762; August 2, 2 Geo. 3, 1762.

George Sanderson, of Exeter, (Devon,) watchmaker: for a new invented machine called a Lunar and Calendar Watch Key, constructed upon mechanical principles, and adapted to every watch hitherto made, and acts thereon no otherwise than a common key, but by means of a screw and wheels of a curious construction is capable of showing in the most accurate manner the age of the moon, the day of the month, the revolution of the tides, and several other motions, which said machine is also constructed to answer all the above-mentioned purposes independent of any watch whatsoever. Cl. R., 2 Geo. 3, p. 4, No. 13. June 25, 2 Geo. 3; Sept. 30, 1762.

Alexander Cockburn, of Berwick-upon-Tweed, fishmonger and curer of salmon for the London market: for a new composition and peculiar method of curing of salmon with spices. Cl. R., 3 Geo. 3, p. 9, No. 14. July 29, 3 Geo. 3; Aug. 17, 3 Geo. 3, 1763.

Richard Tredwell, of Rotherham, spring-maker: for a new method of making and constructing springs for hanging of coaches and all other kinds of carriages upon, so contrived as to be lighter, genteeler, and far easier and safer to the rider than any yet made, &c. Cl. R., 3 Geo. 3, p. 21, No. 4. July 29, 3 Geo. 3, 1763; Oct. 6, 3 Geo. 3, 1763.

Owen O'Keefe, of Long Acre, London, coach-maker: for a new invented axletree and box for the same to run in, to be used for coaches, chariots, &c., which is so contrived as constantly to supply itself with oil, without having occasion to take off the wheels to grease, as is commonly done, and no water or dirt is liable to get into the stock or nave of the wheel, even when it is under water, whereby the carriage will run much smoother, be neater and cleaner, and not liable to fire, as those now used are. Cl. R., 4 Geo. 3, p. 2, No. 5. Dec. 2, 4 Geo. 3, 1763; March 20, 1764.

John Webb, of Steel-yard, London, merchant: for a new invented expedition crane for landing and shipping goods and merchandize, and other useful purposes, whereby much labour and time will be saved. Cl. R., 4 Geo. 3, p. 4, No. 22. March 8, 4 Geo. 3, 1764; July 6, 4 Geo. 3, 1764.

Owen O'Keefe, of Long Acre, coach-maker: for a new invented carriage for hanging coaches, chariots, and all kinds of bodies upon, which is constructed on a new principle, and is much easier to the rider and lighter for the horses, and in many other respects far superior to those now used. Cl. R., 4 Geo. 3, p. 4, No. 10. April 16, 4 Geo. 3, 1764; Aug. 15, 1764.

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John Crumpler, of Lawrence-lane, London, weaver: for an invention of weaving gold and silver wires, and copper wire gilt, either with cotton, silk, thread, or yarn. Cl. R., 4 Geo. 3, p. 4, No. 9. June 18, 4 Geo. 3; Aug. 7, 1764.

John Foster, of Long Acre, (Middlesex,) coachmaker: for a new invented method of making inside seats to coaches, chariots, and all other kind of carriages with braces and springs, whereby the same are abundantly easier to the rider than any other heretofore made. Cl. R., 4 Geo. 3, p. 5, No. 17. May 25, 4 Geo. 3, 1764; Sept. 24, 1764.

John Scott, of Edinburgh, surveyor of land: for a new art and mystery of making glass from one single material, without the help of any composition, which glass is capable of being blown and fashioned into vessels of use of any form, and of a stronger quality than green glass. And also a new and different apparatus and furnaces for making this glass. And also a new art and mystery of making pig iron from one single material never before used by the makers and manufacturers of pig iron in Great Britain, with an apparatus and furnaces for making this pig iron altogether new and different from the blast furnaces now used for making of pig iron, after a new and different manner, and with far less expense by the methods now used in making glass and pig iron. Cl. R., 5 Geo. 3, p. 2, No. 14. Jan. 23, 5 Geo. 3, 1765; April 24, 1765.

Abraham Buzaglo, of London, gent.: for a new machine for warming rooms of all sizes with a coal fire. Certain plans and draughts are referred to, which are not attached. Cl. R., 5 Geo. 3, p. 2, No. 7. April 25, 5 Geo. 3; June 13, 1765.

(*To be continued.*)

NOTES AND NOTICES.

Natural Compass.—It is a well-known fact that in the vast prairies of the Texas a little plant is always to be found, which, under all circumstances of climate, change of weather, rain, frost, or sunshine, invariably turns its leaves and flowers to the north. If a solitary traveller were making his way across those trackless wilds, without a star to guide or compass to direct him, he finds an unerring monitor in an humble plant, and he follows its guidance,—certain that it will not mislead him —*Church and State Gazette.*

Perpetual Motion.—In the year 1813, a belief in the delusive principle of perpetual motion was created throughout a considerable portion of the community of the United States, by a deceptive machine, constructed by one Redhœffer, and had gained sufficient character to induce an inquiry into its reality by the appointment of a committee of the legislature of Pennsylvania. The attention of Mr. Lukens was turned to the subject, and although the actual moving cause was not discovered, yet the deception was so ingeniously imitated in a machine of similar appearance made by him, and moved by a spring, so well concealed, that the deceiver was himself deceived; and Redhœffer was induced to believe that Mr. Lukens had been successful in obtaining a moving power in some way in which he himself had failed, when he had produced a machine so plausible in appearance as to deceive the public.—*Franklin Journal.*

Vote-taking.—A convict in the States Prison of New Jersey has invented a machine for taking the yeas and nays in legislative assemblies. The *Trenton News* thus describes it:—"Yesterday we saw, for the first time, a most wonderful machine, made for the purpose of saving time in taking the yeas and nays in our houses of legislation. The model of this machine has only been completed a day or two, and is not even yet quite ready to be exhibited. The machine, when put into use, is to stand at the clerk's table, and from it two wires are to extend to the desk of each member, terminating in two knobs, one of which should be marked yea and the other nay. When the question is to be taken, and it is announced by the chair, the clerk unlocks the machine by touching a spring, and every member pulls one of the knobs attached to his desk. If he wishes to vote yea, he pulls the yea knob; if he wishes to vote nay, he pulls the nay knob; the whole being done simultaneously and in a moment. The clerk then turns a small brass crank, part way round, and then figures appear before him, in the machine, one of which gives the number of yeas, and the other the number of nays which have been voted, and the third the aggregate of all the votes taken. At the same time, and without any additional movement, the yeas and nays are all distinctly registered on the clerk's catalogue of members, which is printed pretty much in the usual form; the persons voting being marked by a small round hole pricked through the paper. All these operations are done with unerring certainty, and the whole should not require more than a single minute. The size of the house, or the number of members, will make no difference in the time required. As soon as all the members who wish to vote have pulled their wires, the work is complete. The clerk then has only to turn his crank, and in an instant the number of yeas and nays, and the aggregate votes, stands before him, in large figures, and all that he has to do is to declare the result. His marked register will, at the same time, show how every member has voted."—*Boston Daily Advertiser.*

LIST OF ENGLISH PATENTS GRANTED MARCH 2 AND MARCH 3, 1847.

William Eccles and Henry Brierly, of Walton-le-Dale, Lancaster, for improved machinery to be used in spinning. Mar. 2; six months.

John Wood, of Leeds, York, machine-maker, for certain improvements in machinery for spinning fibrous substances. Mar. 2; six months.

Andrew Crosse, of Bloomfield, Somerset, for improvements in treating fermentable and other liquids, so as to cause impurities or matters to be extracted or precipitated. Mar. 2; six months.

Samuel Hunton Townsend Bishop, of Hackney-terrace, Middlesex, for improvements in the construction of the upper part of chimneys. Mar. 2; six months.

James Napier, of Shacklewell-lane, Middlesex, operative chemist, for improvements in smelting copper and other ores. Mar. 2; six months.

Charles Stewart Duncan, of Lombard-street, gentleman, for improvements in public vehicles. Mar. 3; six months.

George Fossick, engine-builder, Thomas Hackworth, engine-builder, and Thomas Elliott, superintendent of locomotives, all of Stockton-on-Tees, for certain improvements in locomotive and other boilers. Mar. 3; six months.

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E. GRANVILLE, Manager.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W.C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1231.] SATURDAY, MARCH 13. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

HENSON'S PATENT SYSTEM OF TRANSFERRING RAILWAY CARRIAGES FROM ONE GAUGE TO ANOTHER.

Fig. 1.

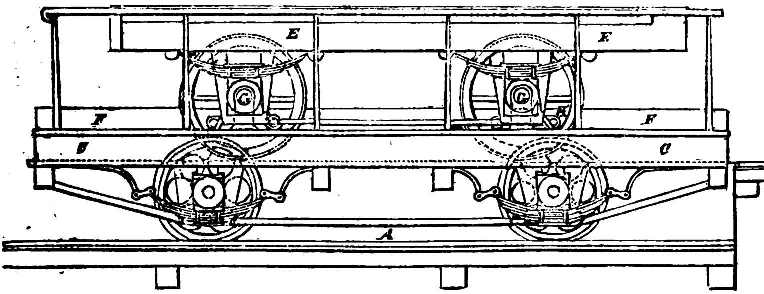


Fig. 2.

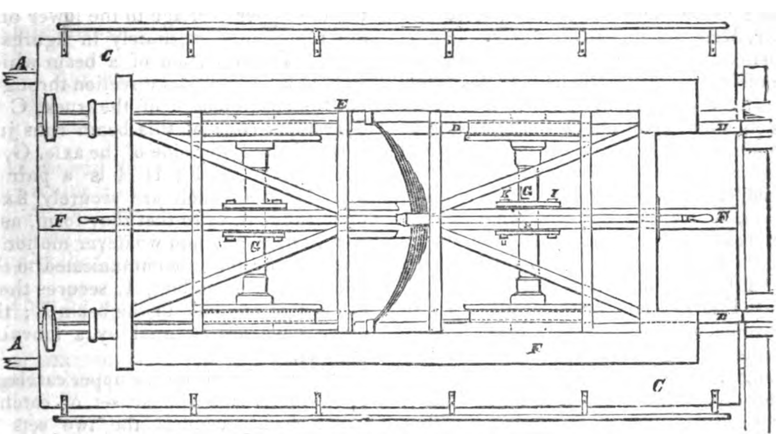


Fig. 4.

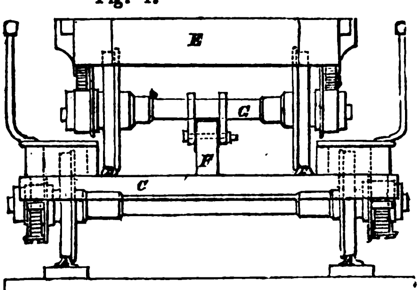


Fig. 5.

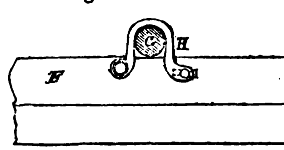
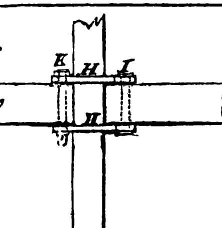


Fig. 3.



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HENSON'S PATENT SYSTEM OF TRANSFERRING RAILWAY CARRIAGES FROM ONE GAUGE TO ANOTHER.

[Patent dated August 30, 1846; Specification enrolled February 28, 1847.]

If there be not some practical objection to the system here presented to the public which we do not foresee, and of which, considering the great experience of the inventor—well known to the railway public for his long and eminent services in the Construction Department of the Northern and Western (late Birmingham and London) Railway—the probability is but small, it offers at length a complete solution of the much-agitated gauge question. A plan somewhat similar was proposed at the time the Gauge Commissioners were occupied with the subject; but it wanted that which we take to be the distinguishing feature of Mr. Henson's system—namely, the graduated difference in the level of the transferring rails. Some may deem this a slight difference; but it is just by such slight differences that the line of demarcation is for ever being marked between the practicable and the impracticable. According to Mr. Henson's plan, it matters nothing whether the transference part be made from the broad to the narrow gauge, or the reverse. His own description of it is as follows:

"Figure 1 is a sectional elevation of portions of two lines of railway, the one being of a broad, the other of a narrow gauge; fig. 2 a plan, and fig. 3 an end elevation of the same. A A are the rails of the broad gauge; C C is a truck with a distance between the wheels suitable for the ordinary broad gauge of 7 feet. The framework is nearly similar to that in use for common railway carriages and trucks. D D are two iron rails fixed upon the upper side of this truck, the distance between which exactly corresponds with the width of the rails of the narrow gauge, or 4 feet 8½ inches. The relative positions of the two lines of railway, at their junction, is such, that if continued, they would run parallel the one with the other, the narrow being within the broad; but there is a difference of level equal to the height of the surface of the rails on the truck, C C, above the surface of the rails of the line on which the truck is intended to run, so that, when the truck is brought into the position represented in figures 1 and 2, a passenger carriage or goods truck may, without any trouble of lifting, be at once run upon it from the narrow gauge line. E E is the under carriage and wheels of the goods truck, which is represented as having been so transferred from the narrow gauge line on to the truck C C, on the broad gauge, and therefore ready, after being fixed, to be conveyed along that line without any further delay.

"The means which I adopt for securing the upper carriage to the lower one, are represented separately in figures 4 and 5. F is a portion of a beam which runs in a longitudinal direction throughout the entire length of the truck, C C. The upper edge of this beam runs just clear of the lower side of the axle, G, of the carriage, E E; H H is a pair of bent catches, which are securely fixed upon the bolt, I, so that they form, as it were, one piece, and whatever motion is given to the one is communicated to the other. The same bolt, I, secures these catches at one end to the beam F; the other ends are secured by a movable rim, K.

"For each axle on the upper carriage, E E, there is a similar set of catches which firmly connect the two sets of trucks."

Mr. Henson's patent includes also several other valuable improvements connected with railways, which we shall subsequently bring under the notice of our readers. Among the most striking of these is a fire and water-proof goods carriage (a thing long and much wanted) —a cattle waggon, so constructed that the animals are removed from it without backing — and a new mode of staying and binding together the body parts of passenger carriages, whereby a disruption of the parts, in case of accident, will be rendered nearly impossible.

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SHORT MULTIPLICATION AND DIVISION.

Sir,—In a former communication I pointed out a short method of finding the roots of cubic numbers exceeding many millions; and engaged to send you other specimens of compendious calculation. Before I proceed, I will take the opportunity of correcting an error in the passage which relates to the duodenary arithmetic in the above article. "The duodenary arithmetic which some extol as superior to the denary, has not this property of forming all the units *of its digits* different from each other." The words in italics should be, "*of the* CUBES *of its digits.*"

The object of this paper is to describe a short method of multiplication and division. I am sorry to be obliged to admit that it is not of general application, so as to be useful in abridging the labour of the computist. I am afraid that it must be ranked among the barren curiosities of arithmetic, suited only for amusement, or exciting wonder among those who do not understand the principle on which the calculation is so readily made.

I shall first produce a few instances of this short method, and then give the explanation.

Take any factor of four, five, or six figures, say

$$476583.$$

We may then take this factor of the same number of figures,

$$142857,$$

and effect the multiplication, without using more figures or employing more time than is necessary for writing down fairly the following line:

$$476583 \times 142857 = 68121789021.$$

Or we may add a fraction which seems to increase the difficulty, but in fact lessens it; as,

$$430365 \times 142857\frac{1}{7} = 61480714285\frac{5}{7}.$$

If we wish to perform an operation apparently more difficult and complicated, we may multiply any given number of three, four, five, or six figures, and by the same act simultaneously divide by 2, 3, 4, 5, or 6, as any one may require; so that the following process may be executed with the same readiness and ease, and in the same time as the former:

$$257642 \times 571428 \div 4 = 36805931\!94.$$

Then for division, we may carry on the process to several decimals,

$$\frac{34678}{625} = 55{\cdot}4848.$$

And multiplying by 5 in addition to the division; as,

$$\frac{784307}{{\cdot}625} \times 5 = 6274{\cdot}456.$$

If, as Hudibras says,

"——— the pleasure is as great
In being cheated, as to cheat,"

I am not sure that I shall not spoil more amusement than I shall give, in explaining this arithmetical artifice. As many tricks of sleight of hand appear nothing when the secret is shown; so it may be here.

The general formula of the solution is

$$a \times b = ca \times \frac{b}{c};$$

that is, if, when we have to multiply two factors together, we increase one and diminish the other in the same ratio, the result is the same.

Thus, multiplying 430365 by a million, and dividing $142857\frac{1}{7}$ by a million, we have

$$430365000000 \times \frac{142857\frac{1}{7}}{1{\cdot}000000}, \text{ or } 430365000000 \times {\cdot}142857\frac{1}{7}.$$

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Now this last factor is the decimal of $\frac{1}{7}$. And

$$430365000000 \times \frac{1}{7} = \frac{430365000000}{7} = 61480714285\frac{5}{7}.$$

Thus, in the multiplication of the above two factors together, I append in my mind six ciphers to the given factor, and divide by 7.

It is scarcely necessary to say more. Any one acquainted with common decimals will see how many multiplications may be performed in the same short and ready way, provided only that one of the factors may be converted into a decimal suited to the purpose. Of course the operator must reserve to himself the power of choosing one of the factors—any one else may dictate the other.

But though what is already said may be enough for the explanation of this short method of multiplying and dividing, yet, for the sake of those who have not made a proficiency in the use of decimal fractions, I will first subjoin a few specimens of this short method, and then mention some curious properties in a certain decimal expression, which is suited to play a conspicuous part in these compendious multiplications. And I am the more disposed to do this, because I am of opinion that these exercises may be usefully employed in schools for teaching learners the value and power of decimal fractions, and may form a good appendage to the common rules in our elementary books.

1. Let 26857 be multiplied by 625.

$$26857 \times 625 = 268570000 \times \cdot 0625$$

$$\cdot 0625 = \frac{1}{16}$$

$$268570000 \times \frac{1}{16} = \frac{268570000}{16} = 16785625.$$

2. Let 3468046 be multiplied by 625, and divided by 5 in one and the same operation:

$$3468046 \times 625 = 3468046000 \times \cdot 625 =$$

$$\left(\text{as } \cdot 625 = \frac{5}{8}\right) 3468046000 \times \frac{5}{8} = \frac{3468046000}{8} \times 5;$$

therefore $\frac{3468046000}{8} = \frac{3468046 \times 625}{5} = 433505750.$

3. Let 479654 be multiplied by 875, and divided by 7 in one and the same operation:

$$\frac{479654 \times 875}{7} = \frac{479654000 \times \cdot 875}{7} = \frac{479654000}{7} \times \frac{7}{8} = \frac{479654000}{8} = 59956750.$$

So much for decimal expressions which represent the full value of the vulgar fraction. But it is not necessary to confine ourselves to these. We may employ an imperfect decimal; but if we do so, another consideration is involved. The process, however, is very little, if at all, more difficult.

I will give an instance, in a smaller sum, to make the explanation more simple:

4. Let 1518 be multiplied by 333.

$$1518 \times 333 = 1518000 \times \cdot 333.$$

Here, as $\cdot 333$ is less than $\frac{1}{3}$, the result will be less than $1518000 \times \frac{1}{3}$. Some deduction therefore must be made. The rule is easy with this decimal. From 506000, the product of those two factors, take 506. The first part of the expression supplies the figures to be subtracted from the last part, as will appear thus:

The full expression of $\frac{1}{3}$ decimally is $\cdot 333\frac{1}{3}$. Now, it is clear that $\frac{1}{3}$ in this place of the decimal signifies $\frac{1}{3}$ of $\frac{1}{1000}$, which indicates the amount to be deducted from the whole—in this case a thousandth part.

$$1518000 \times \cdot 333 = \frac{1518000}{3} - \frac{1518000}{3000} = \frac{1518000 - 1518}{3} = 506000 - 506 = 505494.$$

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This same answer will evidently serve for the two following cases:

Let 1518 be multiplied by 666, and divided by 2 in one and the same operation.

Let 1518 be multiplied by 999 and divided by 3.

It is plain that the same principle may be applied to division.

5. Let it be required to divide 34684 by 125.

$$\frac{34684}{125}=\frac{34{\cdot}684}{{\cdot}125}=34{\cdot}684\times 8=277{\cdot}472.$$

6. Let 358234 be divided by 625, and the quotient multiplied by 5 in one and the same operation.

Multiply, as in the former case, the dividend by 8, striking off three decimals: $\frac{358234}{625}=\frac{358{\cdot}234}{{\cdot}625}=\frac{358{\cdot}234}{5}\times 8=$ the fifth part of $358{\cdot}234\times 8$. Or 358234 is divided by 625 and multiplied by 5, by multiplying 358·234 by 8.

I must reserve the curious decimal expression referred to above for another time.

J.

March 9, 1847.

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from vol. xlv., p. 365.)

Sir,—The following observation properly belongs to the second section of my first *Chapter on Analytical Geometry* which will be found at p. 364 of the last volume of this work. The reader will do well to compare it with some remarks of Professor Young at pp. 287 and 394 of your vol. xliv. Those remarks of that learned mathematician (so far, at least, as they bear upon the employment of the symbol ∞) will serve to clear up any difficulty that may occur.

If in any investigation we arrive at the results

$$y=b,\ y=ax+b,$$

then, x being unrestricted in its value, these two equations respectively represent different straight lines. This is perfectly clear for finite values of a, but what are we to infer when the latter equation takes the form

$$y=0.x+b\ ?$$

This last equation has two meanings: it may mean, first, that the expression for y is perfectly free from x, and, consequently, that the line represented by it is identical with that whose equation is $y=b$; or if we give c every value between 0 and ∞, it may mean one of the equations included in the form

$$y=\frac{1}{c}.x+b,$$

and corresponds to the case when $c=\infty$. So long as x is finite, this line coincides with the line $y=b$, but when $x=c\mathrm{x}$, x being finite, the equation $y=\mathrm{x}+b$ shows that the lines are no longer coincident. In fact, they are inclined to one another at an infinitely small angle, so that for all finite distances from their point of intersection, their divergence is inappreciable, and they may be supposed to coincide without involving us in any error. But in questions in which we must consider the lines in their whole extent, (in questions respecting asymptotes, for instance,) it becomes material to know which meaning to give to the equation

$$y=0x+b,$$

should it occur in our investigations.

When our researches conduct us to such a final result as

$$y=3x-3x+b,$$

we have no difficulty in seeing that the expression for y is *absolutely* free from x—that the co-efficient of x is in fact an absolute zero, and that the first meaning must be given to this result. The second meaning obtains when we have, as a final result, the equation

$$y=\frac{1}{\infty}x+b;$$

where ∞ is the last of a series of continuous values of c.

To avoid the risk of confounding this with the other case is the object which these remarks are intended to attain.

I am, Sir, yours, &c.,

JAMES COCKLE.

2, Church-yard-court, Temple, March 8, 1847.

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CHAP. II. — *Further Remarks on Surfaces of the Second Degree.*

SECTION 1.—*Genera.* Surfaces of the second degree may be separated into two genera; the first comprehending those through every point of which an indefinite straight line may be drawn lying wholly in the surface; the second comprising those surfaces which have not this property. For the sake of convenience let us, for a moment, designate these two genera of surfaces respectively as the *line-surfaces* and the *point-surfaces* of the second degree.

SECTION 2.—*Species of Line-Surfaces.* The equation of the second degree between three variable quantities may represent a *plane*, or a *system of two planes*; a *cylinder*; a *hyperboloid of one sheet*; a *cone*, or a *hyperbolic paraboloid.* It may also represent other surfaces; but those just enumerated comprise all the line-surfaces of the second degree.

SECTION 3.—*Groups.* In the concluding section of my first chapter* I have already intimated the path I shall pursue in classifying the surfaces of the second order. An objection to this arrangement might be taken at the outset. It might even be urged that it is totally inapplicable; that, for instance, a right cylinder, (which, for clearness of conception, suppose circular, and referred to rectangular co-ordinates,) having its axis equally inclined to the co-ordinate axes, has no rectilinear intersection with any plane parallel to any of the co-ordinate planes, while the same cylinder, when its axis is parallel to one of the co-ordinate axes, has rectilinear intersections, with two systems of planes respectively parallel to two of the co-ordinate planes, *i. e.*, to those two of which the co-ordinate axis parallel to the axis of the cylinder is the common intersection. The awkwardness of this classification it would be scarcely worth while to attempt to obviate had we a merely theoretical end in view; but as it will, I think, be found that a purpose of some practical importance may be served by regarding surfaces in this point of view, and rendering that view as perfect as the subject admits, I shall proceed to divide the line-surfaces into three groups. The species contained in the first group will be seen from the following proposition:—

When a line-surface of the second degree can be rectilinearly intersected by an indefinite number of planes parallel to one or more of the co-ordinate planes, that surface is either (1) *a planar, or* (2) *a cylindrical surface, or* (5) *a hyperbolic paraboloid.*

This group comprises, therefore, the first three and the last of the above species of surfaces. The converse of the proposition is not meant to be asserted. Next,—

When a line-surface of the second degree can be rectilinearly intersected by two, and only two planes parallel to the same co-ordinate plane, it is (3) the *hyperboloid of one sheet.*

This group—if group it can be called which contains only one species—comprises the fourth of the species of surfaces above enumerated. In this case the two parallel planes by which the intersection is made may be taken parallel to two, at least, of the co-ordinate planes.

Again:

When a line-surface of the second degree is capable of having rectilinear intersection with one, and only one plane parallel to a co-ordinate plane, it is either (4) *a cone, or* (5) *a hyperbolic paraboloid.*

This group contains the fifth and the last of the above species. In the hyperbolic paraboloid there may be only one co-ordinate plane parallel to which this rectilinear intersection can be made. In the cone there may be none.

SECTION 4.—*Species of Point-Surfaces.* These are the *hyperboloid of two sheets*, the *ellipsoid*, and the *elliptic paraboloid.* It is not necessary to specify the varieties of each species; for instance, the spheroid (ellipsoid of revolution), the sphere, the point, &c.

SECTION 5.—*Their characteristics.* In the preceding remarks on the line-surfaces, we have only had to deal with their real branches, and the properties noticed are purely *geometrical.* In passing to the point-surfaces we are, for the purpose of bringing them under the same system of classification, obliged to have recourse to *analytical* considerations and *unreal* modifications of our former propositions. At page 258 of vol. II. (No. 5) of the *Mathematician*, I have given a proposition relating to the *hyperboloid of two sheets.* It was not perhaps necessary for me to have

* *Mech. Mag.*, vol. xlv., p. 365.

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stated there that, in certain* cases, for this (point-) hyperboloid, "the values of z are unreal and unequal;" for, when z is given by a quadratic, if *one* of its values be unreal, the other is necessarily so, and unequal to the former value; and when z is determined by a simple equation, it is necessarily real, as a little reflection on the processes employed will convince us. If I am not mistaken, the *ellipsoid* will be distinguished by our obtaining two unreal planes, which may, however, pass through real points,—that is to say, the values of the "isololated" co-ordinate may be real. And this may take place for any of the co-ordinate planes indifferently. But as in the hyperboloid of two sheets, the characteristic property† may be confined to two of the co-ordinate planes, so there may be some corresponding modification in the case of the ellipsoid. For the *elliptic paraboloid*, we may obtain one unreal plane passing through a real point. And it may be parallel to one of the co-ordinate planes, only, that the imaginary or unreal branch of the surface can have such unreal rectilinear intersection. The distinction between the ellipsoid and the elliptic paraboloid being as well in the minimum number of co-ordinate planes, parallel to which the unreal branches of those surfaces can have such intersections, as in the number of roots of the equation in z, &c., which is two in the former case, and one in the latter. I wish it, however, to be understood that I do not consider the foregoing remarks as yet complete, but reserve to myself the right of making such additions to, or modifications of them, as, upon a deliberate survey shall appear necessary.

SECTION 6.—*On Certain Formulæ.* On referring to p. 257 of No. 5 of the *Mathematician*, it will be seen that we may add to the equations (1) and (4) the following, for determining s_1 and s', viz.:

$$\sigma^2 - Z'_1\sigma + Z'' \ldots (6)$$

where the values of σ are s_1 and s'.

I shall here make one or two other remarks on the formulæ of the page last cited. And, first, in $U=0$, make $x=Z'_2$, and $y=-Z'_1$, and call the result U_1 then (4) of that page is equivalent to

$$(c^2-4a-1)Z''+U_1=0 \ldots (4a).$$

So that when $Z''=0$, or $c^2-4a-1=0$, the above substitution for x and y changes $U=0$ into (4), and we have, also,

$$\frac{Z'_2}{Z'_1}=a.$$

Again, when all the Z's are zero, we have,

$$-\frac{x}{y}=a.$$

SECTION 7.—*Disappearance of the Squares.* Although when all the squares disappear from $U=0$, the method of the application of which I have given an instance in the work and page just quoted ceases to be of service; yet for the sake of uniformity and generality, I shall give the process by which, under these circumstances, the nature of the surface is determinable, and for this purpose shall suppose it required to ascertain the nature of the surface represented by the equation,

$$ayz+bzx+cxy+abc=0.$$

Assume that the left hand side of this is the product of

$$(\alpha x+\beta)\times(\gamma y+\delta),$$

and, hence,

$$\alpha\gamma=c,\ \beta\gamma=az,\ \alpha\delta=bz,\ \beta\delta=abc,$$

therefore, dividing the third of these equations by the first, and the fourth by the second, we obtain,

$$\frac{\delta}{\gamma}=\frac{z}{c},\ \text{and}\ \frac{\delta}{\gamma}=\frac{bc}{z},$$

which give $z^2=c^2$, or $z=\pm c$, and the surface is one which admits of two, and only two, rectilinear intersections by planes parallel to that of xy, hence it is the hyperboloid of one sheet.

SECTION 8.—*General Remarks.* In considering any given equation of the second degree, we must first seek to reduce it to the *difference* of two squares, if possible. I make this remark because it is possible to reduce the equations of the hyperboloids of one or two sheets to the *sum* of two squares. The principal ambiguity in the application of the foregoing discussion appears to arise when we find that the surface is susceptible of an indefinite number of intersections by planes parallel to a co-ordinate plane. But here, as it appears to me, we shall be enabled to arrive at a conclusion by taking into our consideration the *number of intersections* which the planes have with the surface.

It will not be a matter of much difficulty to recognise the planar surfaces, and may we not distinguish the cylinder from the hyperbolic paraboloid by the fact that (except in the critical case when the cutting becomes a tangent plane)

* The converse of that proposition is not asserted.
† *Mathematician*, vol. ii., p. 258.

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the intersection with the cylinder is *double*, while that with the hyperbolic paraboloid is single? For instance, let it be required to determine what surface is represented by the equation

$$mzx = cy;$$

here there are an indefinite number of rectilinear intersections parallel to the plane of xy, or zy, but they are single, hence the surface is the hyperbolic paraboloid.*

If, then, we take the existence of an indefinite number of single intersections parallel to a co-ordinate plane as the characteristic of this latter surface, it belongs to the first group; if we take the existence of one double intersection parallel to a co-ordinate plane, it belongs to the last group. The cone may also be said to be common to the second and third groups. It is a limiting case of the former group. There is a critical case of the hyperboloid of one sheet in which the intersections of the plane with the surface are parallel. Here it would seem that there is only one value of z—an *essentially* single value, given in the instance which I have in view by an equation of the form ayz=zero. And there are other instances of critical cases which I shall not dwell upon here.

The rectilinear intersection with the cone is in general *double*, but, in the case where the cutting becomes a tangent plane, the intersection becomes single. I have already made a similar remark respecting the cylinder. To mention the point is sufficient to remove any difficulty arising from it.

Any further such remarks upon the line surfaces,† and any inquiry as to whether it be necessary to extend them to the point-surfaces, I must put off till another opportunity.—(*To be continued.*)

ON THE CLAIMS OF CERTAIN GEOMETERS TO THE DISCOVERY OF NEW, AND THE DETECTION OF ERRORS IN OLD, GEOMETRICAL PROPOSITIONS.

Sir,—In the *Ladies' Diary* for 1817, page 47, the following question is proposed for solution by a gentleman who signs himself "Cato Hinde."

"It is required to draw a tangent to the extremity of a given circular arc, without producing the arc, or in any way making use of the centre of the circle."

In the *Diary* for the following year a solution is printed which appears to have been furnished by the proposer, I. A. Dotchen, of whose name "Cato Hinde" is evidently a simple anagram.

Professor Young gives the problem in Prop. 20, Book iv., of his *Elements of Geometry;* and in a note at page 193 ascribes the authorship to Mr. Dotchen: "*Both the question and its solution were printed as* '*Problem xi.*' (*page* 9) *in the first volume of* '*Nicholson's Architecture,*' *published in the year* 1796."

Again, Theorem xvi., Book iv., Simson's Geometry is as follows:—"If two triangles (A B C, *a*, *b*, *c*) have one angle (A) in the one, equal to one angle (*a*) in the other, and the sides (A B, *a b*, C B, *c b*) about either of the other angles proportional; then will the triangles be equiangular, provided these last angles (B, *b*) be either both less, or both greater, than right angles."

Professor Young corrects the erroneousness of this theorem in Prop. 12, Book vi., of his *Elements of Geometry;* and in reference to his demonstration makes the following observations:—"I have therein endeavoured to point out some remarkable errors and inconsistencies into which modern geometers have fallen, particularly in reference to the theory of parallel lines, and the doctrine of proportion; and I believe many of these errors have hitherto remained unnoticed. A singular instance of this is shown in the notes to the Sixth Book, where a proposition in *Simson's Geometry*, which has been for upwards of seventy years received as genuine, and adopted by more modern geometers, is proved to be false?" *Preface*, *page* 9. At page 199, he adds: "It is a singular circumstance that this important error should have hitherto escaped detection, appearing, as it does, in a work of such high repute as Simson's Geometry, which has been in the hands of every mathematician in Europe for the greater part of a century."

Professor Young's work was published in 1827; and in the *Philosophical Magazine* for that year the Editors take occasion to assert similar claims:

"*The theorem, however, was proposed for correction by* '*J. Evans, Edge-*

* These two examples will be found at pp. 60, 61 of Hymers' *Anal. Geo.* (Cam. 1836.)—J. C.

† These include the *plane*, *developable*, and *twisted* surfaces of the second degree. The term "twisted" is, I believe, due to Prof. Davies of Woolwich. To those desirous of an actual *geometrical* acquaintance with some of the surfaces above discussed, I would recommend the perusal of Mr. Davies' papers on *Modern Geometry* published in the *Mathematician*, and, still, I think, in course of publication.—J. C.

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lane, near Royton,' in the Leeds Correspondent for July, 1815, *and is answered as question* 91 *in the number for January,* 1816, *by I. R. G.; and J. Crowther, of Woodhouse-grove. The Editor adds, that the error 'is also noticed in Emerson's Geom., B. ii.,* 16 *Schol.*'"

I am, Sir, yours respectfully,
THOMAS WILKINSON.

Burnley, Lancashire, March 6, 1847.

PREVENTION OF BOILER INCRUSTATIONS.

Sir,—I hope that you will with your wonted kindness allow me, by the medium of your knowledge-spreading Magazine, to inquire the opinion of scientific men on the following question:

Would a new, or clean steam-boiler be prevented from incrustation by putting in its inside either charcoal or cotton? The reason for the affirmative supposition of my inquiry is briefly this:

I conceive that the first particles of the alkaline and earthy matters, dissolved or suspended in the water, adhere to the boiler by no other force but by the mutual attraction of the two oppositely electric bodies, the metal being negatively electric with respect to the alkalies, which are, in their turn, positive with respect to the metal; hence, I conclude, that if we should bring the boiler into contact either with charcoal or cotton, which are negatively electric, not only with alkalies, but even with metals, the boiler would thereby become positive, and would not attract the alkalies, which would by an elective affinity adhere to the more negative body of the charcoal or cotton.

I am, Mr. Editor,
Your respectful and obliged servant,
S. HOGA.

14, Nassau-street, Middlesex Hospital.

BREAKWATERS—SIR SAMUEL BENTHAM'S PLANS.

Sir,—Your Number of Saturday last gives an article on Floating Breakwaters, the author of which, after speaking of those of Captain Groves, Major Parlby, and Mr. White, the earliest of which was, "about twenty or thirty years ago," says he is "not aware of any other proposition for the establishment of floating breakwaters." By this it appears that he had not seen your number of July 13, 1844, since in it particulars were given of a floating breakwater proposed to the Admiralty, September 24, 1811, by Brigr. Gen. Sir Samuel Bentham. There still exists, in the United Service Museum, the original rough model on a small scale of that breakwater; and there is also one copied from it in the Museum of King's College.

This model exhibits a structure very simple, and mechanically devised for strength, as each side respectively of the triangle forms diagonal braces to the other two sides; whilst Sir Samuel's mode of putting wood-work together by means of the cognes of his invention, would in this case, as in ship-building, have insured the permanent juncture of the parts, without play, or admission of water at the fastenings.

Another variety of floating breakwater, Sir Samuel invented and proposed to the Admiralty so long ago as April 8, 1797. It was for making a boat-pond, and for protecting boats from the dashing of the sea in Portsmouth Harbour. His proposal ran thus: "This new boundary might be composed of a row of piles, in number and strength just sufficient to the purpose of affording a steadiment to a set of *floating beams*, constituting in this manner a sort of floating fence, rising and sinking with the tide. The security afforded by this inexpensive barrier would serve not only against the sea, but also against plunderers, to whose depredations that part of the dock-yard is known to be but too much exposed."

I am, Sir, your obedient servant,
M. S. B.

March 8, 1847.

PROGRESS OF THE ELECTRIC TELEGRAPH IN AMERICA.

[We have collected together from various American sources the following notices of the progress of the electro-telegraphic system in America. It will be seen from these that Brother Jonathan is "going ahead" of us, much in the same way as he did in the case of steam navigation. We are in hopes that, by making known the great strides he is making in this department, we may help to excite at home a little more spirit of enterprise in the same direction. Comparing all that has been achieved here, with what has been done in the United States, it amounts really to next to nothing.—ED. M. M.]

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Extract of a Letter from Professor Morse, to the Commissioner of Patents, dated February 2, 1846.

In compliance with your request, that I would give you some facts in relation to my electro-magnetic telegraph, illustrative of the difference between my system and other systems more recently established in Europe, I would say that, with a view of personally examining electric telegraphs in England and France, I made a rapid tour in those countries in the autumn of the last year. The electric telegraph most in use at present in Great Britain, is that invented by Messrs. Cook and Wheatstone, the former of whom, it appears, had his attention first drawn to the subject at Vienna, in 1836, and Professor Wheatstone dates his own invention from the year 1837.

The electric telegraph upon the Paris and Rouen railroad is the joint production, I believe, of M. Foy and M. Brequet, and conceived and executed within the last two years.

* * * *

Professor Wheatstone invented his first telegraph in 1837. It was an improvement of Baron Shillings's *needle telegraph*, invented in 1833. The *deflection* of the *magnetic needle* is the basis of both. The *attractive power of the electro-magnet*, which is the basis of my printing telegraph, invented in 1832, was used by Wheatstone in 1837, simply to release the detent of a common alarum to give notice to the attendant that a communication was about to be made. This magnet was made to act by a special circuit, by means of which a magnetic needle was deflected, and closed a circuit with a local battery which charged the magnet. This is the only purpose for which the power of the electro-magnet was used in the telegraph by Professor Wheatstone, until the year 1841. There is no instance of any attempt to record or print characters by means of magnetism previous to my invention.

* * * *

The invention of Professor Wheatstone I critically examined in September and November last, (1845,) at the Nine Elms, and at the Paddington station, London, and also at Amsterdam, in October. At Paddington, I gave a name of 19 letters to be transmitted, and requested specially that it should be sent and returned as speedily as possible, as I wished to test the number of letters that could be shown in a minute. The result was, that the name (after several failures to spell it right, and giving sometimes the letter before and sometimes the letter after the true letter in the alphabetic arrangement in the disc) was completed in one minute and a quarter. I inquired how many could be shown in a minute, and learned that ordinarily 15 or 16 letters, although 20, and even 24, had been recognised. This rate was corroborated at the Amsterdam station of the Harlaem and Amsterdam line, on which Wheatstone's disc telegraph is used. 15 or 16 letters per minute was the usual rate of transmission; but I found here, as at Paddington, that the disc did not rotate with correctness; often giving the wrong letter, so that the word was generally guessed at, and frequently required repetition. In this arrangement Professor Wheatstone uses but one circuit.

In Paris, in the latter part of October and beginning of November, 1845, I examined the telegraphic system in operation upon the experimental line, made by order of the government, between Paris and Rouen, a distance of 85 miles. This system is an ingenious application of a rachet-wheel escapement, acted upon by an electro-magnet, to the movement of two arms, imitating the configurations of the aërial telegraph already in use in France.

* * * *

With this arrangement M. Brequet states that 10 configurations or signs can be given in a minute. In a note, however, from Mr. Fox, the accomplished administrator of the telegraphs of France, he informs me that 28 have been given in a minute; but ordinarily it can only give 10 or 12, and *this* (it will be perceived) requires two circuits; consequently it gives at the rate of 6 signs ordinarily, or at the utmost 14 per minute, for a single circuit.

It will be sufficient to state that by my system I give, with a single circuit, at least 60 characters in a minute, not merely shown temporarily, but recorded in a permanent manner upon paper, to be read at any time.

The efficiency of the three systems will stand thus represented in figures:

The American system, 60 per minute;

The English system, 15 per minute;

The French system, 6, or at most 14 per minute.

With the advantages in favour of the American, that the characters are made permanent and the operation of the instrument surer, the simplicity of the machinery rendering it less liable to be deranged by atmospheric changes or other accidents.

Letter from Professor Morse to the Philadelphia Ledger, January 8, 1847.

Messrs. Editors,—I noticed an announcement in your papers of yesterday, that I had recently made "some improvements in my telegraph, for which I had entered a caveat at the patent-office." It is true that

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I am taking measures to secure by patent some recent modifications of my telegraphic apparatus, simplifying the printing of my telegraphic alphabet; my experiments on this point having been satisfactory. It is true also, that I have applied a fact in electro-magnetism, (never before to my knowledge applied,) in the construction of an apparatus for printing *the common letters of the alphabet*, and I have devised an apparatus of the greatest simplicity.

But simple as it is, incomparably more so than any contrivance for that purpose as yet published, I really do not attach any great importance to it, for the reason that it is mathematically demonstrable, and that from the very nature of such a contrivance, it cannot successfully compete in the rapidity of recording intelligence with the simple mode I have in use, and which is a consequence, mainly, of the intervention of my telegraphic alphabet. For example, the President's message, entire, on the subject of the war with Mexico, was transmitted with perfect accuracy (exclusively for and at the expense of the *Baltimore Sun*) at the rate of 99 letters per minute. My skilful operators in Washington and Baltimore have printed these characters at the rate of 98, 101, 111, and one of them actually printed 117 letters per minute, and I have little doubt that the accomplished operators in your *Philadelphia* office could easily show similar results. He must be an expert penman who can write legibly more than 100 letters per minute; consequently my mode of communication equals, or nearly equals, *the most expeditious mode of recording thought*.

A Rochester paper recently contained a paragraph, which has been extensively copied—to the effect that there was a new invention about to appear, which was to "impress every letter distinctly on paper," and "*of course*," the writer observes, "do away with the characters to represent the alphabet." The effect of such an invention is by no means such *a matter of course* as the writer supposes.—Allow me a word on that point.

My very earliest conception of the telegraph embodies this idea, to wit: "The marking in a permanent manner of a character to denote the intelligence transmitted." It was certainly very natural, then, that the marking of the common letter of the alphabet should be suggested to my mind, and I of course expended sufficient thought upon the subject to perceive that it was practicable in several ways, but also that any way at that time was necessarily complicated. I was intent on simplicity, and adopted my present system because of its simplicity and greater efficiency.

My friend and co-proprietor in the telegraph, Mr. Vail, some time in the spring of 1837, was intent on producing an instrument of this kind, and gave the project much thought. I uniformly discouraged him, however, on the ground, not that such a plan was impracticable, but, in comparison with the method I had devised, worthless, since, were such a mode perfectly accomplished and in actual use, my more simple mode would inevitably supersede the more complicated mode. Mr. Vail, in his work entitled "The American Electro-Magnetic Telegraph," discusses this whole matter from page 157 to 171. Experience has proved that when my system has been put to the test in competition with the common letter-printing telegraphs in Europe, mine has been proved superior. In Vienna, for example, Mr. Bain's letter-printing telegraph (the most ingenious as yet published) was explained with mine publicly before one of the largest and most learned assemblies ever convened in that capital, comprising the court and nobles of Austria, and the American telegraph carried the day by acclamation, and is now adopted by that government.

I wish it distinctly understood, therefore, that my present invention of an apparatus for printing the common Roman letter, was not induced by any expectation that it will supersede my present plan, but solely to give the choice to any, who, after all the evidence that has been long published of the intrinsic unimportance of such a result, may be desirous of seeing the common Roman letter printed, instead of my simple character signifying the same thing. I accomplish this result by the use of an apparatus very far less complicated than any published here or in Europe. I remain, gentlemen, your most obedient servant,

SAMUEL F. B. MORSE.

Telegraphic Dispatch.

The first message of Governor Young to the New York Legislature was commenced reading in the House of Assembly at Albany on Tuesday, 5th inst., (Jan., 1847,) at 18 minutes before 12, New York time, and was transmitted to New York by the New York, Albany, and Buffalo Telegraph Company, and the entire document complete was placed in possession of the editors of this city at 3 o'clock, P.M. The message contained 5000 words, or 25,000 letters, and was written from two instruments in the Albany office, by Messrs. Carter, Buel, and Johnson, and read in the New York office

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by the Messrs. Woods, at the rate of 83 letters per minute, or two and a half hours for each instrument. Professor Morse's original estimate to Congress for the despatch with which communications could be sent by his telegraph, was thirty letters per minute. Here we see the number almost trebled in a long public document.—*Scientific American.*

Magnetic Telegraph.

The approach of the steamer *Cambria* was announced in Boston by means of the marine telegraph, while the vessel was yet nearly forty miles from the harbour. But this news did not stop at Boston, but was, within five minutes, also announced in New York, by means of the magnetic telegraph. We were also apprised at New York of the progress of the *Cambria* as she entered the harbour, and at the moment she passed into the dock. By this wonderful medium of intelligence, the arrival of the steamer was reported in Springfield, Hartford, New Haven, New York, Philadelphia, Baltimore, and Washington before the vessel reached the wharf in Boston: and the principal items of news were published in most of those places at the same time, and within one hour from the time they were published in Boston.—*Ibid.*

SALVAGE OF STRANDED VESSELS.

While the *Great Britain* remains on the beach where she first foundered,—saved for a time from utter destruction by the breakwater of fagots which has been thrown up under Mr. Brunel's direction, to protect her from the violence of the waves, yet still without any certainty of ultimate rescue,—another iron steamer, the *Sphynx*, belonging to the royal navy, has been stranded in a similar manner at the back of the Isle of Wight, but—got off. The means which have been adopted in the case of the *Sphynx* are thus described in a letter from the Portsmouth correspondent of the *Times*, dated 5th March:

"The plan devised for this object was by means of 'camels'—the project of Commander Caffin, of the *Scourge* steam sloop, and Mr. Watts, the senior assistant-master shipwright of this dockyard—the buoyant power of which amounted to above 130 tons, brought under a strong framework constructed under her paddle-boxes. To these were added by Mr. Watts, subsequently to Commander Caffin's leaving, another camel, which was brought under the head of the vessel, on which, at the extreme foremost end, was erected a high framework for supporting the chain cables, hawsers, &c., used in heaving the vessel off, and to obviate or counteract this downward pressure, at the end of the camel, next the stem, was fixed a fork formed by means of two stout pieces of fir timber placed a little more than the breadth of the stem asunder, and bolted firmly to the deck of the camel. This fork came underneath two stout cleats fastened to the stem of the vessel, so that the downward pressure of the cables when hove upon, constituted a power, at one end, of a lever to lift the bow of the ship at the other end. This was found to render most important aid in getting the vessel over the bank or reef of rocks, up to which she had been brought, but could not be got over. This ledge has not more than six feet of water on it at high tide, whereas the *Sphynx* when lightened of everything except her engines, drew 10 feet of water. The feat, therefore, of getting her over the reef is one of the most remarkable incidents ever recorded in naval science."

We know not whether Captain Caffin and Mr. Watts read the *Mechanics' Magazine*, as many of their brother officers are in the habit of doing; but however this may be, it is certain that they have but applied to the *Sphynx* the means which our correspondent, Dr. M'Cormac, of Belfast, had previously recommended to be employed in the case of the *Great Britain*—(see *Mech. Mag.*, vol. xlv., p. 558.)

With respect to the *Great Britain*, it appears from the reports made to a recent meeting of the shareholders, that, as far as the breakwater is concerned, it has proved perfectly effectual for its intended purpose; but that "the best mode of removing the ship" is a point still standing over for Mr. Brunel's consideration. "The sea," says Captain Claxton, to whom the actual construction of the breakwater was entrusted, "now first strikes through this barrier of beech trees and lateral poles,—the former, in some places, three deep, the entire number 70 with the ship's spars,—the whole fixed in the foundation of fagots, chained together at the heel, and hove tight down from their heads with tackles—about 150 spars are lashed laterally and diagonally outside of these from the sand to the ship's gunwale—the fagots, with the exception of the foundation, are all built within these, resting against the ship's

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side,—filling the hollow of the port quarter; and as the sea is forced, with whatever violence, through the openings of this net-work of spars, which commences at the starboard quarter, and extends to abreast of the mainmast on the port, or exposed side, it is received by the mass of fagots, and not only is its whole force lost, as it were, but, although the spray is thrown up to the height of the funnel over the after-mast, there is no shock whatever to the ship."

IMPORTANT USES OF CHLORATE OF BARYTES IN CHEMICAL INVESTIGATIONS.

Sir,—Very often it happens that new acids are originally formed in combination with potash, more particularly the numerous ones that are derived from vegetable or animal bodies, and which may be, on the application of any strong acid, resolved and decomposed, so that the real acid is difficult to isolate—perhaps considered impossible at the time. Now, on adding chlorate of barytes to the salt of potash, the latter is decomposed, or changed into chlorate of potash, and the former into a salt of the new acid, with a base of barytes, from which the acid may be obtained pure by means of dilute sulphuric acid. The barytic salts are not so liable to destruction by powerful acids as the potash salts. It is true, that if the barytic salt of the new acid is *insoluble*, it can be obtained by the addition of simple muriate of barytes; but if it be *soluble*, what other salt can supply the place of the chlorate of barytes? The resulting chlorate of potash falls, of course, being so slightly soluble in saline solutions.

Nothing can be more simple than the manufacture of chlorate of barytes:—Make a saturated solution of chlorate of potash, and pass fluo-silicic and gas through it; filter the chlorine acid from the fluo-silicate of potash, and saturate it with ground carbonate of barytes and crystallize. All the requisite materials are cheap—as cheap as can be—with the exception of chlorate of potash, which costs nearly 2s. per lb. at the makers; the sulphuric acid, the fluor spar, and the ground flint for the fluo-silicic acid, and the ground carbonate of barytes, to form the base, are all well known to be of low prices. The chlorate of barytes ought not to cost more than about 3d. or 4d. per oz., and, if made on a large scale, even cheaper, as I have no doubt but that it will play an important part in the laboratory of the experimental chemist, particularly if his studies be directed to organic analysis or investigations.

I remain, Sir, yours, &c.,

G. H. LONSDALE.

FRENCH TRACING PAPER.

Sir,—I enclose you some pieces of a sample of French tracing paper, combining the qualities of stoutness and transparency. The dealer in Paris, from whom it was bought, declared that the paper undergoes no process after leaving the mill, and that the transparency exists in the pulp, before being formed into a sheet.

A similar article would be a great desideratum in this country; and I trust I am not entailing too much trouble on you to forward, on application being made, a sample to any manufacturer. In testing its qualities, I would suggest one—of holding a small piece over the flame of a candle, when the paper immediately becomes blistered and opaque.

I have only to add my opinion, that any successful manufacturer would command a great sale. Pray append a note expressive of your opinion.

S.

[The tracing-paper, of which our correspondent has sent us specimens, is the very finest we have ever seen. Any manufacturer, desirous of having a specimen, may have one sent to him by favouring us with his address.—ED. M. M.]

BANCROFT'S PATENT PROCESS OF REFINING AND PURIFYING ANIMAL AND VEGETABLE OILS, TALLOW AND LARD.

[Patent dated June 12, 1846.]

To Purify Animal and Vegetable Oils.—The vegetable oils which I make use of to be refined for the above said purpose, are the common olive oils, Galipoli, Spanish, Portugal, Sicily, and such like qualities of olive oils. It is well known that these oils when applied in their impure state to the working parts of machinery quickly become glutinous, act injuriously upon brass-work, and impede the proper working of machines; this effect is produced by the action of the air upon the impurities contained in the oil when the oil is exposed in small quantities. To remove this hurtful matter, I treat the oil, heated to about 90°

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or thereabouts, with a strong solution of potash or soda, either in the state of a carbonate, or made caustic by lime. I generally prefer to use the alkali in a caustic state, in consequence of its producing less effervescence in the oil, and the operation being more quickly finished than when the carbonates of either of the above alkalies are made use of. I usually prefer to use the solution of the alkali at a specific gravity of 1·2, or even stronger. During the addition of the alkali, the oil is to be kept in a constant state of agitation, to cause the one to mix thoroughly with the other. To ascertain when the operation is completed, and a sufficiency of the solution added, I take a small portion into a glass bottle, or any other convenient vessel, and add to it a solution of the alkali in excess, shake it well, and then allow it to remain at rest for a quarter of an hour, or until the alkali has settled at the bottom of the vessel; should the alkali settle quite clear, without causing a thick deposit to take place, I conclude that the oil is sufficiently refined; if it does not remain clear, but carries down with it a thick soapy matter, I add more alkali to that in operation, until on further trial this effect takes place; the quantity of alkali required will depend entirely upon the quality of the olive oil operated upon. I have found in practice, that some qualities have required as much as 8 per cent. of solution of specific gravity, 1·2, while other qualities have not required more than 3½ per cent. When the above operation is completed, I then allow the oil to remain at rest for twenty-four hours, or until such time as the thick soapy matter formed in the oil by the alkali has subsided, the supernatant oil may then be run off, and passed through a filter; the oil so operated upon will not be found to tarnish the most delicate brass-work, nor will it become thick and glutinous upon exposure to the air. The animal oil which I treat to be used for the same purposes as above, is the oil expressed from lard. My mode of refining this oil is exactly similar in all its details to the above.

To Purify and Refine Tallow.—My process for refining and purifying tallow, so as to make it more valuable for the purposes of lubricating the pistons of steam-engines, and other similar purposes, is the following: but first I may observe that all tallows are not applicable, those which I have found most suited to my purpose being those which are termed in commerce Y, C, of light yellow colour, and sweet or good home rendered tallow. I melt tallow of the above description by steam or other heat; when the tallow has become fluid, but before it has become much heated beyond its melting point, I add, as in refining olive oil, a strong solution of potash or soda, either caustic or in the state of a carbonate, and of specific gravity 1·2, or thereabouts. I add this solution of the alkali with constant agitation of the tallow during its introduction. Upon the first introduction of the alkali a very thick soapy matter is precipitated; the operation is completed, when upon a further addition of the alkali this effect ceases to be produced; the tallow is then heated to about 180° or 200° of temperature. I then allow it to repose for 24 hours or more, according to the quantity operated upon and the heat of the weather. When it is perceived that the tallow in cooling is becoming slightly opaque, it is run off into casks, which, while cooling, must be well stirred to prevent it from granulating.

To Refine and Sweeten Lard.—My process for refining and sweetening American and inferior lards, is as follows:—In using American lard, it is in most cases too soft and oily, I therefore, before operating upon it, extract a portion of the oil by pressure. I then melt the lard by steam or other heat, and add as before a strong solution of potash or soda, or carbonate of these alkalies, with constant agitation of the lard. This process is exactly similar to my process for refining and purifying tallow.

WARD'S PATENT PROCESS OF MANUFACTURING SALTS OF SODA AND MAGNESIA.

It is well known to those engaged in the manufacture of soda ash, that, after the liquor or lyes from the black ash has been evaporated or salted down, that the ash thus obtained contains a large quantity of caustic soda, and sulphuret of sodium. To render this ash into a fit state for making soda crystals, it is desirable to convert the caustic soda into carbonate of soda, and the sulphuret of sodium into sulphate, or sulphate of soda; and for this purpose it is usual to mix sawdust with the ash, either during the operation of salting it down in the furnace, or after that it has been drawn therefrom, and previous to its being introduced into the carbonating furnace.

This mixture of ash and sawdust, when brought into the carbonating furnace, is worked in the usual way, with a slow fire at first to burn off the sawdust; the fire is then increased sufficiently to communicate to the ash a red heat, and maintained until the ash is in a proper state to be used for making crystals of soda.

During this process it is found, that whilst the sawdust is in a state of combustion, the caustic soda and sulphuret of

sodium are fused and form small globules, which retard the process of carbonating and the conversion of the sulphuret of sodium into sulphate, or sulphate of soda. It is also a matter of experience, that the caustic alkali dissolves a portion of the sawdust, or carbonaceous matter, and gives to the alkaline solutions a greenish or dark colour, that is, if the ash be drawn from the carbonating furnace before the action of the fire has fully removed the colouring matter.

In consequence of the difficulty experienced in getting rid of the colouring matter in the carbonating furnace, it has been found useful to employ a solution of the chloride of lime, in order fully to remove this greenish or dark tint from the alkaline liquors, previously to making use of them in the manufacture of crystals of soda.

In order to obviate these difficulties, which occur in the process just mentioned, and to obtain a more perfect carbonate of soda, Mr. Ward takes carbonate of magnesia in the state of fine powder, in the proportion of from three to seven per cent. of the dry ash, according to the quantity of caustic, soda, and sulphuret of sodium which may be present in the ash operated upon, and he mixes this proportion of such carbonate of magnesia with the alkaline liquors when they are being boiled down to the state of ash in the salting-down furnace, or with the ash, after it has been drawn from that furnace, and previously to its being introduced in the carbonating furnace.

The ash thus mixed with the carbonate of magnesia is put into the ordinary carbonating furnace, and submitted to the usual treatment for about three hours for 700 cwt. of ash. The advantages derived from the use of carbonate of magnesia in this operation are twofold. In the first place, the carbonate of magnesia being infusible at the greatest temperature required in this operation, has the effect of keeping the mass of ash in a porous and open state, thereby greatly facilitating the conversion of the sulphuret of sodium into sulphite or sulphate of soda, and the caustic soda into carbonate of soda. In the second place, the carbonate of magnesia being subjected to a red heat, as is the case in this process, gives out carbonic acid, which, uniting with the caustic soda, forms carbonate of soda. The ash, when taken from the carbonating furnace, is dissolved in water; the magnesia subsides, and carries down with it any oxide of iron that may be present in the solution of the carbonate of soda, and leaves the liquor in a fit state for making crystals of soda. If, on examination, the liquor derived from the ash be not clear and free from colour, it shows that the ash did not remain sufficiently long under the influence of the fire in the carbonating furnace to produce the above effect.

The magnesia thus precipitated is separated from the liquor, and, after being washed with water to remove alkaline liquor fully from it, is allowed to settle in a tank, and when taken from the tank, it may be dried and used to advantage, in the same manner as the carbonate of magnesia, as above described in the manufacture of soda-ash; or else it may be transferred into suitable vessels of stone or lead, where sulphuric acid and water may be added in such proportions as will produce a saturated solution of sulphate of magnesia, of about the specific gravity 1165. The patentee prefers making use of sulphuric acid of the specific gravity 1750, in order that it may, when mixed with water, produce sufficient heat to dissolve readily the magnesia.

The saturated solution of sulphate of magnesia, thus obtained, is pumped into another vessel, and enough sulphuret of magnesium added to precipitate any iron which is present in the state of sulphate of iron: by this addition of sulphuret of magnesium, sulphuret of iron and sulphate of magnesia are formed.

Sulphuret of calcium may be used in this process to supply the place of sulphuret of magnesium; in this case, sulphuret of iron and sulphate of lime will be the salts formed. It is necessary to use the sulphuret of calcium cautiously; for should it be added in excess, it will decompose the sulphate of magnesia. It is also necessary, in order fully to precipitate the iron, to add sulphuret of magnesium or calcium, until a black precipitate ceases to take place.

The sulphuret of calcium, which may be made available in the foregoing process, is prepared from vat-waste, an oxysulphuret of calcium produced during the decomposition of the sulphate of soda in the manufacture of soda-ash. It may be obtained in a state fit for use by pouring hot water on the vat-waste, and allowing it to remain about six hours in the vat, and then running it off. When the sulphuret of iron has subsided, Mr. Ward draws off the clear liquor, and conveys it into a leaden pan, and boils it until it acquires the usual specific gravity; it is afterwards run into crystallizing vessels, and finished in the usual manner. If, after the separation of the sulphuret of iron from the liquor, as above mentioned, it is found to contain any colouring matter derived from the sulphuric acid, or any other source, a clear liquor may be obtained by mixing a small quantity of chloride of lime, in solution, to the liquor,

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previous to boiling it preparatory to crystallization.

The sulphuret of magnesium Mr. Ward prepares as follows:—He takes sixty parts by weight of the dry sulphate of magnesia, and forty parts by weight of coke, finely powdered; and having introduced them into a common iron retort, he subjects the retort to the action of fire until the whole mass shall have been maintained at a red heat for about six hours. The contents of the retort are afterwards taken out, and, when cold, dissolved in hot water. The liquor thus obtained, being separated from the insoluble impurities, is then fit for use.

Heretofore Epsom salts have been manufactured from magnesian lime-stone, which requires to be calcined and washed, in order to separate the carbonate of magnesia; but Mr. Ward finds that, in some cases, native carbonate of magnesia is found in a state of purity, or else so slightly mixed, that it may be considered pure, for the purposes of his invention.

Part therefore of his invention consists in employing native carbonates of magnesia in the manufacture of Epsom salts, without subjecting them to calcination and washing. The native carbonates of magnesia which he has employed have been lately imported from Greece; and when he uses native carbonate of magnesia, without calcining and washing, for the manufacture of Epsom salts, he either applies it first in the manufacture of carbonate of soda, as above explained, or else puts the native ore into a vessel, and pours sulphuric acid upon it, and then proceeds to treat it in a manner similar to that used (as hereinbefore described) for converting the magnesia, after its separation from the soda-ash, into Epsom salts or sulphate of magnesia.

A DUCKING SKIFF.

A sportsman—down east of course—has constructed a skiff expressly for the pursuit of ducks and other aquatic game. The skiff is covered with bushes and shrubbery; the sportsman lies flat on the bottom, with his gun resting on the bow. Near the stern is a vertical shaft, which passes through the bottom, which is furnished with a stuffing box, to prevent leakage. The shaft operates as a *rudder post*, and is supported at the top by a thwart or cross-bar, and has a yoke attached above the stuffing box, by means of which the shaft and its appendage below are operated by the feet or toes of the sportsman as he lies in the boat. To the bottom of the shaft, below the boat, is attached a horizontal rod extending fore and aft: and through each end of this rod, a vertical pivot passes, extending about four inches above and below the rod. On each end of each pin is mounted a piece of thin board or float, a foot long, and four inches wide, sharp at each end. The pivot extends through each, edgewise, near the forward end of each; and to the aft end of each float, a small cord is attached in such a manner as to prevent the float from changing its position on the pivot more than twenty-five degrees. In consequence of this check, when the rod is moved to the right or left by means of the yoke, the floats operate obligingly upon the water, and propel the boat forward, though perfectly silent. The sportsman can thus approach either ducks or geese in the water, without giving any alarm.—*Scientific American.*

SEWING MACHINE.

The American papers make mention of a machine invented by one Elias Howe, which sews beautiful and strong seams in cloth as rapid as nine tailors! The following claims, in the words of the patentee, may give some idea of the nature of the invention:

"I claim the lifting of the thread that passes through the needle eye by the lifting rod, for the purpose of forming a loop of loose thread that is to be subsequently drawn in by the passage of the shuttle; said lifting rod being furnished with a lifting pin, and governed in its motions by the guide pieces and other devices.

"I claim the holding of the thread that is given out by the shuttle, so as to prevent its unwinding from the shuttle bobbin, after the shuttle has passed through the loop; said thread being held by means of the lever, or clipping piece.

"I claim the manner of arranging and combining the small lever, with the sliding box in combination with the spring piece, for the purpose of tightening the stitch as the needle is retracted.

"I claim the holding of the cloth to be sewn by the use of a baster plate, furnished with points for that purpose, and with holes enabling it to operate as a rack, thereby carrying the cloth forward, and dispensing altogether with the necessity of basting the parts together."

NEW METHOD OF MIXING OIL-COLOURS.

Sir,—The following is a very simple, but most effectual method of working up powdered colours into a fine homogeneous paint, with linseed, or other drying oil. It consists essentially of a hollow cylinder, with a plug or piston made to fit

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very accurate, which is capable of being moved up and down at pleasure by means of a screw, worked in the same manner as a screw press. The bottom of the cylinder is, in shape, exactly like the top of a paper pill-box, only that it is made to screw on, and is perforated with $\frac{3}{8}$ or $\frac{1}{2}$-inch holes, placed pretty close together. Between this bottom and the cylinder five or six layers of fine gauze are placed, and in such a manner that the finest is next the perforations, then a degree rougher for the one next to this, and so on for the rest.

On working down the piston by a lever, the fine colour oozes out through the perforations, in a most perfect state of mixture, and of a degree of fineness hitherto unattainable, except by a most laborious and lengthy process of trituration, while, by this contrivance, the paint passes out very quick. Of course, it must not be thought that this apparatus is designed to *grind* colours in hard lumps, but merely to *mix* or incorporate those generally sold already ground into fine powder, or such as exist naturally in that state.

The colours most suitable to be treated in this way are lamp-black, vermilion, ochres, red-lead, soft chrome yellows, carmine, French ultramarine, flake white, Venetian red, Indian red, Brunswick greens, iodine scarlet, verdigris, emerald green, marine blue, light red, and their endless combinations one with another, for the various wants of the house-painter or artist in oil-colours. The colours that will require to be previously ground to powder are, the lakes, raw and burnt sienna, raw and burnt umbers, cobalt, Prussian blue, Antwerp blue, mineral green, Vandyke brown, brown pink, indigo, Italian pink, dragon's blood, cyanide brown, hard chromes, Cologne earth, madder brown and madder reds, Naples yellow, &c. For working on a small scale, a moderate sized coffee-mill will do very well to grind the dry pigments, which must be afterwards sifted through the finest muslin sieve, and the rougher particles returned to the mill again.

For manufacturing stiff printing-inks, or white-lead paste, nothing could be better than this little machine.

I am, Sir, yours, &c.,

T. W. N.

RAILWAY WHEEL TYRES.

Sir,—From the evidence of Mr. Gooch, concerning the late unfortunate accident on the Great Western Railway, it does not appear that any adequate *test* is employed to prove the soundness of tyres for railway wheels. I have read with some interest the evidence of those experienced engineers who were examined at the adjourned inquest; but still I do not see that they offer any suggestion for *proving* the tyres of the wheel before putting them to use.

As I am not an engineer, and merely desirous of suggesting a plan which by chance may be found useful, I hope to be excused from technical detail as well as error; but I have often heard of wheels in factories flying all to pieces when turning round with immense velocity. The tendency of all bodies rotating is also said to be that of throwing off their parts in the direction of a tangent, as drops of water in the swinging of a mop. This has suggested to me the possibility of applying centrifugal force as a test for railway wheels and the tyres of wheels. To apply this power with great effect, it seems to me only necessary to fix one, two, or even a number of wheels on one common axle, and then by steam power subjecting them to a rotation of intense velocity. This, by means of large wheels acting successively on small, I imagine will be no difficult problem for an engineer to solve. The test could be rendered still more severe, and in some degree resemble the action of frost, by causing a small stream of ether or pure alcohol to drop over the outward edge of the tyre as it turns round; this by the rapid evaporation would produce great cold and powerful contraction.

I am, Sir, your obedient servant,

WM. GALLARD.

Cardington-street, Euston-square,
February 2, 1847.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 239.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

Isaac Fenn, of Swallow-street, Hanover-square, (Middlesex :) for a new invented

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perambulator, or measuring wheel of 31½ inches diameter, with a box fixed in the centre, and three or four hands to denote poles, furlongs, and miles to an exactness of 5 inches, and the whole enclosed in a walking stick, as a portable instrument fit for gentlemen and ladies to measure roads or lands. A plan of the plate, with its hands and numbers, is drawn in the margin of the membrane; also of a compass and needle which may be added to the said plate. A bell may likewise be added to strike at the several distances of poles, furlongs, &c. Cl. R., 5 Geo. 3, p. 10, No. 11. July 15, 1765, 5 Geo. 3; Nov. 7, 6 Geo. 3, 1765.

Richard Tredwell, of Rotheram, coach spring maker: for new invented springs for saddles, pillions, and their stirrups, whereby the shake and hard motion of a horse is taken away, and the rider sits much steadier and easier than upon those now used, and will also greatly ease the horse. Cl. R., 5 Geo. 3, p. 19, No. 15. Oct. 29, 5 Geo. 3, 1764; Feb. 20, 1765.

Richard Tredwell, of Rotheram, coach spring maker: for new invented springs for saddles, pillions, and pads, and their stirrups, whereby the shake and hard motion of a horse is taken away, and the rider sits much steadier and easier than upon those now used, and will also greatly ease the horse. Cl. R., 5 Geo. 3, p. 19, No. 14. Oct. 29, 5 Geo. 3, 1764; Feb. 20, 1765.

John Milne, of Manchester, wire worker: for a new invented machine for dressing the flour of wheat and barley, &c., which will make a more lively and better flour than bolting cloths (which is the common method now used) from the same corn. It will dress all sorts of flour, and divide the sharps from the bran at one operation; and the person that attends it may easily make two sorts or only one, by moving the partitions that divide the flour, which must be within the box or case in which the machine works. A plan of the invention is drawn upon the membrane. Cl. R., 5 Geo, 3, p. 20, No. 2. May 10, 5 Geo. 3; July 15, 1765.

Thomas Lindslee, of St. George-in-the-East, (Middlesex,) potter: for a composition for the making of fictile pipes for the conducting of water and other fictile wares, and a method of making and burning the same, so as the same shall be as hard and durable as stone. Cl. R., 6 Geo. 3, p. 3, No. 11. March 25, 6 Geo. 3; July 18, 6 Geo. 3, 1766.

Gowin Knight, of the British Museum, doctor of physic: for a new method of constructing compasses in general, so as to prevent them being affected by the motion of the ship in rough weather, or such other kinds of motion as hitherto have impeded or lessened their general utility, which new method of constructing the variation compass in particular, will be better adapted for taking the sun's azimuth and amplitude, and the bearing of distant objects than those now used. Cl. R., 6 Geo. 3, p. 4, No. 13. June 10, 6 Geo. 3, 1766; Oct. 7, 1766.

William Blakey, of Saint Mary-le-bone, engineer: for a new invented machine which performs its operations either by fire or fall of water, or both, and the friction is thereby reduced so as to have no solid bodies to rub, but the injecting vapour and water-cocks or sluices, whereby there will be a saving of about one-third of force, and which said invention may be applied to all sorts of mills, such as grinding corn, &c. A parchment schedule of drawings is attached. Cl. R., 6 Geo. 3, p. 4, No. 12. June 10, 6 Geo. 3; Oct. 9, 1766.

John Purnell, of Froombridge, iron master: for a new invented machine for making ship bolts, large round rods of iron and steel, and iron and steel wire of various sizes, that is in many respects far more serviceable and preferable than any method that has hitherto been made use of for that purpose [by rolling]. Cl. R., 6 Geo. 3, p. 18, No. 7. July 31, 6 Geo. 3; November 15, 1766.

Thomas Cranage, of Bridgnorth, forgeman, and *George Cranage*, of Colebrooke Dale, founder: for an art of making pig or cast iron malleable in a reverberatory or air furnace, with a raw pit coal only, without the application of any other mixture or ingredient, by a method entirely new. Cl. R., 6 Geo. 3, p. 19, No. 21. June 17, 6 Geo. 3; August 18, 6 Geo. 3, 1766.

John Stewart, of Saint George-in-the-East, (Middlesex,) merchant: for a new invented machine which performs its operations by the power of such common fire [steam] engines as are used in raising water out of mines, which it is apprehended will answer all the purposes of wind, water, and horse mills. Cl. R., 7 Geo. 3, p. 1, No. 31. Sept. 6, 6 Geo. 3; January 3, 1767.

Richard Tredwell, of Covent-garden: for a new invented method of making springs for the ease and convenience of coaches and other carriages, with a worm and pin, and either with or without a plate, fixed in several forms and shapes to answer many useful purposes. Cl. R., 7 Geo. 3, p. 1, No. 8. Nov. 8, 7 Geo. 3, 1766; March 2, 1767.

Isaac Levy, of London, merchant: for a new invented method for conveying timber from beyond sea by floating machine; in its external form somewhat similar to and like that of a ship, with decks, &c. &c. Cl. R., 7 Geo. 3, p. 1, No. 6. Dec. 17, 7 Geo. 3, 1766; March 13, 1767.

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William Champion, of Bristol, merchant: of the art or mystery of refining copper for making brass by wrought iron, and of making brass by a mineral called Black Jack, or Brazil, instead of Calamy, or Lapis Calaminaris, and for manufacturing brass into brass wire by stone or pit coal, instead of wood now used. Cl. R., 7 Geo. 3, p. 3, No. 13. Jan. 26, 1767; April 21, 7 Geo. 3, 1767.

Henry Hardy, of Saint Luke, (Middlesex,) frame-work knitter, *Thomas Davies*, of New Bond-street, hosier, and *Andrew Dorila*, of Saint Luke, (Middlesex,) frame-work knitter: for a method, entirely new, of making and manufacturing velvet shag and brocaded silks, plain, cut, figured, and in gold and silver, upon a stocking frame. Cl. R., 7 Geo. 3, p. 4, No. 2. June 2, 7 Geo. 3; Sept. 18, 1767.

Henry Fought, of Salisbury-court, Fleet-street, London, gent.: for certain new and curious types for the printing of music notes as neatly and as well in every respect as hath been usually done by engraving. A delineation of the several characters and division of characters to be used in the course of the said invention, is given in the margin of the roll. Cl. R., 8 Geo 3, p. 3, No. 5. Dec. 24, 8 Geo. 3; April 20, 1768, 8 Geo. 3.

William Prince, of the Strand, London: for a new method or invention of making starch, with the use of machines entirely, from other ingredients than wheat, wheat flour, pollard, bran, or potatoes. Cl. R., 8 Geo. 3, p. 3, No. 1. Jan. 2, last; May 2, 8 Geo. 3, 1768.

Robert Albion Cox, of Little Britain, London, smelter and refiner: for a new invented method of smelting and refining of gold, silver, copper, lead, and its ores, and the waste and sweepings thereof, with the foul slaggs drawn therefrom by means of a new and peculiar method of grinding, washing, and working the same, and constructing the smelting and testing furnaces. Cl. R., 8 Geo. 3, p. 4, No. 5. March 8, 8 Geo. 3, 1768; July 8, 1768.

John Bootie, of Saint Martin's-in-the-Fields, brazier: for tinning copper and brass vessels. Cl. R., 8 Geo. 3, p. 6, No. 8. Aug. 13, 8 Geo. 3; Dec. 10, 1768.

Arnold Finchett, of Fleet-street, London, tin plate worker: for a new invented aromatic and sweet-scented oils. Cl. R., 9 Geo. 3, p. 1, No 4. Feb. 10, 9 Geo. 3; June 2, 9 Geo. 3, 1769.

Thomas Norris, of Duke-street, Westminster, chemist: for a new invented medicine or drops for the cure of fevers and all inflammatory disorders, being also of sovereign efficacy in many chronic disorders, and operating without the least violence or disturbance to the animal economy, even to the most delicate constitution. Cl. R., 9 Geo. 3, p. 2, No. 19. Dec. 7, 9 Geo. 3; April 5, 9 Geo. 3, 1769.

James Watt, of Glasgow, Scotland, merchant: for a new invented method of lessening the consumption of steam and fuel in fire [steam] engines. Cl. R., 9 Geo. 3, p. 2, No. 12. Jan. 5, 9 Geo. 3; April 25, 1769.

James Hodges, of Lambeth, (Surrey,) wood hat weaver: for a new invented art or mystery of weaving wood hats in a loom. Cl. R., 9 Geo. 3, p. 4, No. 7. Oct. 28, 10 Geo. 3; Nov. 6, 1769.

Sampson Freeth, of Birmingham, merchant: for hand corn-mills for the grinding of wheat in private families. An engraving of the machine has been printed upon the roll. Cl. R., 9 Geo. 3, p. 7, No. 19. Oct. 6, last past; Jan. 30, 9 Geo. 3, 1769.

James Taylor, of Ashton-under-Lyne, watchmaker: for a machine for raising weight or water in a more simple and easy manner than anything heretofore discovered. Cl. R., 9 Geo. 3, p. 22, No. 2. August 4, 9 Geo. 3; Nov. 25, 10 Geo. 3, 1769.

John Porter, *Sinckler Porter*, and *Josiah Crane*, of Nottingham, hosiers and frame-work knitters: for an engine or machine, on which is fixed a set of sliders, and which engine is fixed to a stocking frame for shading and brocading, working and making of gold, silver, silk, worsted, cotton, and thread flowers, and other figures, upon silk, cotton, thread, and worsted pieces for waistcoats, breeches, stockings, gloves, and mitts, and upon all goods and pieces usually made and manufactured in the stocking frames, by a method entirely new. Cl. R., 10 Geo. 3, p. 7, No. 21. Nov. 16, 10 Geo. 3; Feb. 14, 1770.

Richard Lovell Edgeworth, of Hare Hatch, (Berks,) esq.: for a new invented portable railway, or artificial road, to move along with any carriage to which it is applied. Cl. R., 10 Geo. 3, p. 15, No. 21. Feb. 5, 10 Geo. 3; April 20, 1770.

Thomas Bailey, of Moorfields, London, saddler: for an invention of making and manufacturing saddles and housings, or saddle cloths, so as the same shall greatly exceed in beauty, convenience, and durability any saddles and housings, or saddle cloths, made and manufactured on any other construction or principle. Cl. R., 11 Geo. 3, p. 7, No. 3. Dec. 7, 11 Geo. 3; April 4, 1771, 11 Geo. 3.

Thomas Crawford, of London, merchant: for an engine for winding silk, thread, and yarn, and which will wind and frame silk at one motion, and at the same time, and will also wind silk, thread, and yarn single,

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double, and in several threads together at one and the same time, the construction and power of which engine far exceeds any invention hitherto discovered, as well by preserving the finest silk threads or yarn from breaking, and by preventing all manner of obstructions which can arise from the several threads entangling with each other. Cl. R., 11 Geo. 3, p. 9, No. 12. Dec. 18, last; April 8, 11 Geo. 3, 1771.

James Edgell, of Frome Selwood, gent.: for a new invented, cheap, and simply constructed water engine, (made principally of wood, except the air vessel thereto belonging,) which will throw a constant stream of water with great force and at a great distance, and will be very useful in extinguishing fires. Cl. R., 11 Geo. 3, p. 10, No. 2. April 22, 1771, 11 Geo. 3; August 7, 11 Geo. 3, 1771.

Thomas Aldersey, of Southwark, looking glass manufacturer: for a machine for grinding and polishing plate glass, which not only performs the said operations very expeditiously, but in a manner vastly superior and quite different from the common method now in use. Cl. R., 11 Geo. 3, p. 11, No. 8. Feb. 26, 11 Geo. 3; June 19, 1771.

Isaac Moore, of Queen-street, Upper Moorfields, and *William Pine*, of Bristol, letter-founders, printers, and partners: for an entirely new and particular method of casting cases in metal for holding and containing metallic letters or printing types of a peculiar construction, to fix in the said cases for marking or printing on silk, muslin, linen, woollen, leather, paper, parchment, and vellum, together with raised letters for signs, monumental inscriptions, and other purposes. And also new invented printing presses, the platens whereof are made of iron and other metals, as well as of wood, and are suspended or counteracted by a balance or weight. Cl. R., 12 Geo. 3, p. 1, No. 10. Nov. 6, 11 Geo. 3; Feb. 21, 12 Geo. 3, 1772.

William Whitlock, of Covent-garden, embroiderer, and *William Hodgson*, of Holborn, carver: for a composition called (by the specifier) "Artificial Wood," applicable to the various purposes of carving, casting, and modelling [a species of papier maché]. Cl. R., 12 Geo. 3, p. 2, No. 3. April 3, 12 Geo. 3; July 15, 12 Geo. 3, 1772.

Solomon Henry, of Swithin's-lane, London, merchant: for an instrument or machine which will in a great measure prevent burglaries, and also prevent fires from spreading by giving immediate notice to the inhabitants of any dwelling-house that may be attacked, or in which any fire may break out, and in case such housebreakers should persist, will also detect such housebreakers. Cl. R., 12 Geo. 3, p. 3, No. 27. Feb. 6, 12 Geo. 3; May 27, 1772.

Coniah Wood, of Nottingham, turner: for a machine or engine of an entire new construction, whereby the spinning of wool and Jersey tow or flax into thread or yarn may be performed in a far more expeditious manner than the same hath hitherto ever been done, by which machine or engine a great number of threads may be spun at one and the same time on a number of spoals, and the same machine be managed by one person alone. Cl. R., 12 Geo. 3, p. 10, No. 20. June 11, 12 Geo. 3; July 24, 1772.

William Tutin, of Birmingham, buckle maker: title not specified.* Cl. R., 12 Geo. 3, p. 10, No. 17. June 13 last; Sept. 30, 12 Geo. 3, 1772.

Robert Webster, of Whitby, watchmaker: for an entirely new and particular kind of repeater, or repeating watch, of a peculiar and much more simple construction than any invention of the like nature hitherto found out. Cl. R., 12 Geo. 3. p. 17, No. 7. July 31, 12 Geo. 3; Nov. 17, 13 Geo. 3, 1772.

Adam Walker, of Manchester, (Lancaster,) lecturer on natural philosophy: for a new method of producing continued tones upon an instrument called by the specifier a Celestina—a new piece of mechanism. Cl. R., 12 Geo. 3, p. 17, No. 1. Aug. 29, 12 Geo. 3; Dec. 19, 13 Geo. 3, 1772.

John Budge.—A drawing and description of a machine for raising of heavy materials from great depths, enrolled by fiat of 5 Mar., 1773: the draught has been made upon the Roll. Cl. R., 13 Geo. 3, p. 1, No. 3. Patent not recited. Feb. 8, 1773.

Samuel Archer, of Goswell-street, London, diamond cutter: for new invented mock pearls. Cl. R., 13 Geo. 3, p. 4, No. 10. April 3, 13 Geo. 3; August 2, 13 Geo. 3, 1773.

Christopher Gullett, of Tavistock, gent.: for a hydraulic engine to be worked by water only, for drawing, raising, and lifting up ores, coals, and other weights and substances from mines, pits, shafts, and other deep places, and for working buckets, kibbals, &c., and making them to continue to work, and to ascend and descend alternately at pleasure, and also draw water in buckets, and work common whims and other such

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* The title given in the specification is "A method of Japanning Mourning Buckles of a blue cast or colour, so as to equal and far exceed in cheapness and wear the common blue coloured mourning buckles, which are so coloured by the heat of the fire and which are liable to be damaged by wet, which the japanned ones are not."

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like machines, without the assistance of horses or any other power, (water only excepted.) Cl. R., 13 Geo. 3, p. 5, No. 12. June 17, 13 Geo. 3; Oct. 4, 13 Geo. 3, 1773.

James Butler, of Lichfield, (Stafford,) coachmaker: for an invention of spring wheels for carriages. Cl. R., 13 Geo. 3, p. 6, No. 14. Nov. 13, 13 Geo. 3; Feb. 17, 13 Geo. 3, 1773.

Henry Clay, of Birmingham, japanner: of an invention of making, in paper, high varnished panels or roofs for coaches, and all sorts of wheel carriages and sedan chairs, panels for rooms, doors, and cabins of ships, cabinets, book-cases, screens, chimney-pieces, tables, tea-trays, and waiters. Cl. R., 13 Geo. 3, p. 6, No. 1. Nov. 20, 13 Geo. 3; March 11, 1773.

John Wright, of West Bromwich, iron-master and copartner with Richard Jesson, of the said parish, iron master: for a method of making malleable iron from pig or sow metal, commonly called cast iron, and from skull and cinder iron or other cast metal, with raw coals, or coke, without charcoal and without granulations, mixture of fluxes, or other infusions. Cl. R., 13 Geo. 3, p. 12, No. 15. Date of patent not given; Dec. 2, 1773.

Christian Wilhem Baron Van Haake, of Rochester: for a new invented secret, art, or mystery in extracting and making a certain composition called (by the specifier) "Baron Van Haake's Composition," that is productive of the effect of manuring and improving arable land, meadow, and pasture ground. Cl. R., 13 Geo. 3, p. 16, No. 6. July 30, 13 Geo. 3; Nov. 27, 14 Geo. 3, 1773.

George Fordyce, of St. Clement's Danes, doctor in medicine: for a preparation of blood, which is prepared so as to preserve those qualities which will render it useful for the making of sugar for a great length of time and in any climate. Cl. R., 14 Geo. 3, p. 2, No. 3. Jan. 24, 14 Geo. 3; May 20, 1774.

George Shepley, of Horsley Down, Southwark, leather dresser: for a new invention and discovery of grinding or reducing to powder bark for tanning leather, and Brazil wood, logwood, fustick, madder, indigo, saltpetre, and all other woods, drugs, roots, minerals, and colours used in dyeing, by certain millstones of a particular form and construction, placed horizontally and worked with the wind or water. Cl. R., 14 Geo. 3, p. 3, No. 6. June 27, 14 Geo. 3; July 9, 14 Geo. 3, 1774.

James Edgell, of Frome Selwood, gent.: for a compound balance or engine, by which waggons and other carriages, and also all heavy goods, wares, and merchandizes may be weighed with ease, despatch, and accuracy. Cl. R., 14 Geo. 3, p. 4, No. 1. Sept. 10, 1774, 14 Geo. 3; Nov. 30, 15 Geo. 3, 1774.

John Hatchett, of Saint Martin-in-the-Fields, Westminster, coachmaker: of a new invented art or mystery for making ornaments, (such as arms, supporters, borders, ciphers, and all manner of flowers, and other ornaments), to add to the flowers for coaches and other carriages. Cl. R., 14 Geo. 3, p. 6, No. 7. Nov. 10, 15 Geo. 3; Nov. 17, 1774.

Joshua Lover Martin, of Fleet-street, London, optician: for an invention of a new spring screw fastening for sashes. Cl. R., 14 Geo. 3, p. 7, No. 9. July 19, 14 Geo. 3; Nov. 18, 1774.

Christopher Chrysel, of St. George, Gloucester, engineer: for a new invented method of constructing and setting boilers of any dimension for the use of fire [steam] engines, salt-works, brewhouses, distillers, soap-houses, sugar-houses, and sugar-works. Cl. R., 14 Geo. 3, p. 13, No. 6. Nov. 7, 14 Geo. 3; March 8, 14 Geo. 3, 1774.

John Wilkinson, of Brosely, iron master: for a new method of casting and boring iron guns or cannon, "which the specifier has proved, upon repeated trials, to be a great improvement." Cl. R., 14 Geo. 3, p. 15, No. 10. Jan. 27, 14 Geo. 3; March 23, 1774.

Isaac Whitehouse, of Birmingham, enameller: of an invention of making coat-buttons, breast-buttons, sleeve-buttons, vest, and other buttons, studs, bracelets, necklaces, lockets, rings, watch-chains, boxes, and trinkets. Cl. R., 14 Geo. 3, p. 27, No. 5. Aug. 31, 14 Geo. 3; Dec. 24, 1774.

Solomon Henry, of Swithin's-lane, London, merchant: of an invention of an instrument, or machine, for weighing the coin of this kingdom, and also for ascertaining whether the said coin is counterfeited, or any base metal mixed therewith. A plan of the invention is drawn upon the roll. Cl. R., 15 Geo. 3, p. 1, No. 26. Sept. 12, 14 Geo. 3; Jan. 7, 1775.

Joshua Lover Martin, of Fleet-street, London, optician: of an invention and capital improvements on a certain instrument commonly called Hadley's Quadrant, or Sea Octant and Sectant. Cl. R., 15 Geo. 3, p. 1, No. 15. Nov. 25, 15 Geo. 3; March 23, 1775.

Owen O'Keefe, of Long-acre, coachmaker: of an invention of a new and particular carriage for coaches, chariots, chaises, waggons, and all other vehicles to be used with four or three wheels. Cl. R.,

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15 Geo. 3, p. 3, No. 8. Aug. 1, 15 Geo. 3; Oct. 31, 16 Geo. 3, 1775.

Francis Underwood, of Ampthill, (Bedford,) plumber and glazier: of a new invention of casting and working into frames of any figure or size for small bar sashes, fan-lights, sky-lights, or any other lights, doors, or partitions; a compound which will, in every respect, answer the purpose of wood, iron, brass, or copper. [A composition of tin and lead.] Cl. R., 15 Geo. 3, p. 6, No. 6. Dec. 14, 15 Geo. 3; March 23, 15 Geo. 3, 1775.

Charles Hawkins, of Hereford, saddler: of a new invention of pillions or mail pillions. Cl. R., 15 Geo. 3, p. 13, No. 18. June 10, 15 Geo. 3; Sept. 30, 15 Geo. 3, 1775.

Pierre Theodore de Bruges, of Piccadilly, gent.: of an invention of a new and peculiar method of making saltpetre. (The method of making it is given in English and French.) Cl. R., 16 Geo. 3, p. 16, No. 19. Oct. 27, 16 Geo. 3; Feb. 24, 16 Geo. 3, 1776.

Alexander Cumming, of Bond-street, watchmaker: for a water-closet upon a new construction. Cl. R., 16 Geo. 3, p. 16, No. 16. Nov. 11, 16 Geo. 3; March 1, 1776.

Robert Wakefield, of Brownlow-street, Holborn, (Middlesex,) surgeon: of a new invented art of making medicinal and compound powders for the assistance and relief of young children afflicted with gripes and convulsions. Cl. R., 16 Geo. 3, p. 16, No. 1. Feb. 22, last; June 18, 16 Geo. 3, 1776.

NOTES AND NOTICES.

Captain Warner's Projectile.—The Government Commissioners have finally reported that this long range affair falls so much *short* of all that was predicated of it, and is besides so uncertain in its effects, that they cannot recommend its adoption in the public service.

Lord Dundonald's Long Range.—We understand that the secret official trial to ascertain the effect of a continuous evolution of intense gas in projecting shells or shot from a tube, resulted on an average in throwing 25 six-pounder shot to the distance of 7,000 yards. From this data it is clear that balls of greater diameter would far exceed the range of common artillery. Another important advantage is said to accrue—namely, that the continuous rush during their emission would prove much less injurious to vessels projecting such missiles than the shock or recoil of single discharges. We learn that Lord Dundonald's ingredients produce an elastic emission, like that which would be evolved by kindling the end of a hawser or cable formed of hard twisted gun-cotton.—*Hampshire Telegraph.*

Quick Work.—A steamer is now floating on the waters of Lake Ontario, built at Kingston, U. C., of iron, the ore of which was in the earth, in Scotland, in March last.—*American Paper, January*, 1847.

The Bowie Knife and its Inventor.—This instrument was devised by Colonel James Bowie, an American, and a man of desperate valour. He considered, and apparently with justice, too, that, in close fighting, a much shorter weapon than the sword ordinarily in use, but still *heavy* enough to give it sufficient force, and, at the same time, contrived to cut and thrust, would be far preferable, and more advantageous to the wearer. He accordingly invented the short sword, or knife, which has since gone under his name. It is made of various sizes; but the best, I may say, is about the length of a carving knife—case perfectly straight in the first instance, but greatly rounded at the end on the edge side; the upper edge at the end, for the length of about 2 inches, is ground into the small segment of a circle and rendered sharp; thus leaving an apparent curve of the knife, although in reality the upturned point is not higher than the line of the back. The back itself gradually increases in weight of metal as it approaches the hilt, on which a small guard is placed. The Bowie knife, therefore, has a curved, keen point; is doubled edged for the space of about a couple of inches of its length, and when in use, falls with the weight of a bill hook. Bowie went to Texas during the troubles which preceded the independence of that country,—and was lying sick in bed at the fortress of the Alamo, when, on the 6th of March, 1836, it was stormed by Santa Anna and taken. Bowie was murdered there upon his pillow. The hand that formed the dreadful knife could no longer wield it.

The *Amphion*, a new screw-propelled war-steamer, was tried last week down the river. She had the whole of her armament on board, consisting on the upper deck of two 56-pounders, eight 32-pounders, and two land service guns, (on traversing platforms,) and on the lower deck, four 8-inch guns, and sixteen long 32-pounder guns, with a large quantity of shot and shells. When she left her moorings the tide was running up with a strong north-east wind against her. The engines, when set to work, made 36 revolutions per minute, and gradually increased their velocity to 44 per minute, which was the highest number during the trial. The engines on Count Rosen's principle are different from any used in the Royal Navy, being on a similar principle to locomotives engines, and acting horizontally with a four-feet stroke directly attached to the axle of the screw-propeller with which she is fitted, and dispensing with the use of cog-wheels, required for the *Rattler*, the *Fairy*, the *Dwarf*, and other screw-propeller vessels. The engines of the *Amphion* are only 150-horses power each, and were found sufficient to give the vessel a speed of 6¾ knots in an hour and a half against wind and tide. When her full speed is attained she will average about six knots per hour. The engines worked remarkably easy. The vessel during the trip was immersed 17 feet 11 inches in the fore part, and 18 feet 4 inches aft.

Freshening Sea-Water.—"A Lieutenant, R.N.," gives in the *Times* the following account of an extemporaneous method of converting sea-water into fresh, adopted by the crew of the *Levant* packet when lately wrecked on a reef of rocks near the Colorado Islands:—"An iron pot was converted into a boiler to contain salt water, a lid was fitted to it out of the root of a tree, leaving a hole of sufficient size to receive the muzzle of the gun-barrel, which was to act as a steam-pipe, the barrel was run through the stump of a tree hollowed out in the middle, and kept full of cold water for the purpose of condensation; and the water so distilled escaped at the nipple of the gun-barrel, and was conducted into a bottle placed to receive it. By this contrivance on an average sixty bottles, or ten gallons of distilled water, was procured in 24 hours, which was perfectly clear and free from salt."

Hardening Grain before Grinding.—A patent has been taken out in America by J. W. Howlett and F. M. Walker for an improved process of toughening the hulls of wheat or other grain, by passing the same through a jet or current of steam immediately preparatory to grinding. The patentees say: "The utility of toughening the hulls of grain in some way previous to grinding, and also the difficulty of effecting this desideratum uniformly, is

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well known to practical millers. When grain is ground in too dry a state, the hulls are so tender and brittle that a portion of them are pulverized and pass through the bolt with the flour, disfiguring its appearance and greatly deteriorating its merchantable value."

American Railroad Iron.—The first bar of American railroad iron was made in 1844, and there are now sixteen or eighteen foundries at which it is made, and these make over 120,000 tons per annum. This amount is sufficient to lay four miles of railroad per day; or twelve hundred miles per year. The progress of this manufacture, in the short space of two years, in this country is very remarkable, and is a strong manifestation of American enterprise and skill.

The Electro-magnetic Spark.—Faraday was the first to elicit the electric spark from the magnet; he found that it is visible at the instants of breaking and of renewing the contact of the conducting wires; and only then.

Around the magnet, Faraday
Is sure that Volta's lightnings play;
But *how* to draw them from the wire?
He took a lesson from the heart:
'Tis when we meet, 'tis when we part,
Breaks forth the electric fire.

"M" in *Blackwood.*

Franklin and Morse.—The following toast was lately given at a public meeting at Chicago, (Mass.) —"Benjamin Franklin and Samuel Morse—the one drew lightning from the heaven—the other gave it voice, and bade it speak to the world."

The Light of the Sun.—Dr. Wollaston calculates that it would take 5563 candles placed at the distance of twelve inches to give a light equal to that of the sun.

Bell-casting.—A bell has been just cast for the Montreal Cathedral, at the foundry of Messrs. Mears, in Whitechapel, which is stated to be the largest ever cast in this country. The quantity of metal fused was about 25 tons.

LIST OF ENGLISH PATENTS GRANTED FROM MARCH 5 TO MARCH 10, 1847.

Richard Roberts, of Manchester, engineer, for improvements in machinery for punching and for preparing metals. March 5; six months.

Richard Roberts, of Manchester, engineer, for improvements in machinery to perform the processes called beetling, mangling, and the like. March 5; six months.

Amédée François Rémond, of Great Charles-street, Birmingham, for certain improvements in steam engines. March 9; six months.

Matthew Sproule, of Liverpool, engineer, for certain improvements in steam engines. March 10; six months.

James Stevens, of Darlington Works, Southwark Bridge-road, engineer, for improvements in apparatus for conveying signals or communications between distant places, parts of which are also applicable to lamps and burners. March 10; six months.

Hasimir Vogel, of St. Paul's Churchyard, manufacturer, for a new manufacture of weavers' harness, and for machinery for the production of the same. March 10; six months.

John Isaac Hawkins, of Liverpool-street, King's Cross, civil engineer, for certain improvements in holding together or filing letters, music sheets, newspapers, and other documents. March 10; six months.

Edward Johnson Coale Atterbury, of Leeds, York, merchant, for certain improvements in gearing machinery. (Being a communication.) March 10; six months.

James Murdock, of Staple-Inn, Middlesex, patent agent, for an improved mode of preparing and employing certain colours and materials for painting. (Being a communication.) March 10; six months.

Louis Nicolas de Meckenheim, of Birmingham, machinist, for a certain improvement, or certain improvements in machines to be used in the manufacture of nails, screw blanks, rivets, bolts, and pins. March 10; six months.

William Newton, 66, Chancery-lane, civil engineer, for certain improvements in engines to be worked by gas, vapour, or steam, either separately or in combination. (Being a communication.) March 10; six months.

Henry Fletcher, of Over Darwen, Lancaster, manufacturer, for improvements in apparatus for ascertaining the distance which locomotive engines and carriages have travelled upon railways. March 10; six months.

Thomas Waterhouse, of Edgeley, Stockport, Chester, for certain mechanical improvements applicable to railway engines and tenders, and to railway carriages of various kinds. March 10; two months.

Advertisements.

Patent Metal-Cored Railway Sleeper Company.

CAPITAL £100,000, in 10,000 Shares of £10 each. Deposit 1s. per Share, as limited by 1 and 2 Victoria, cap. 110, to be made up to £1 per Share on complete registration. Not less than three months' interval for future calls.

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John Waller, Esq.

Bankers—Messrs. Masterman, Peters, Mildred, Masterman, and Co.

Solicitors—Messrs. Tustin and Barlow, Bridge-st., Blackfriars.

Standing Counsel—Charles Stewart Drewry, Esq.

Superintendent—Joseph Orsi, Esq.

It is remarkable that, whilst great improvements have year after year been made in locomotive engines, the construction of the road upon which those engines are to run has remained without any improvement since the time when the Liverpool and Manchester Railway was made.

The great improvements which have been introduced into locomotive engines have now, however, rendered it absolutely necessary for engineers to turn their attention to the best means of improving the construction of what is called the permanent way of railways.

With a view to such object this Company has been projected, for the purpose of introducing a new kind of railway sleeper, which has been patented, and which embraces many advantages, besides those of economy and unlimited durability. They have been tested on the London and North-Western (London and Birmingham) for the last ten months, and for which line a further quantity are in course of manufacture.

Prospectuses, setting forth many of such advantages, and forms of application for shares, may be had at the offices of the Company, 1, Guildhall-chambers, Basinghall-street, where specimens of the sleepers may also be inspected.

NOTICE is hereby given that no further applications for Shares will be received after the 16th inst.

1, Guildhall Chambers, Basinghall-street,

March 4, 1847.

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To Inventors and Patentees.

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Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

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LOWE'S Submarine Steam Ship Propeller of Curved Blades Sections of a Screw.

The Proprietors of this Patent will proceed immediately to appoint Agents at the Outports of the Kingdom. Application by letter to be made at the Offices of the Proprietors, No. 19, Tooley-street, Southwark. Lloyd's Agents will have a preference.

EDWARD JENKIN,
Secretary.

The Idrotobolic Hat.

MESSRS JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1232.] SATURDAY, MARCH 20. [Price 3*d.*

Edited by J. C. Robertson, 166, Fleet-street.

AMERICAN LETTER PRINTING ELECTRO-MAGNETIC TELEGRAPH.

Fig. 1.

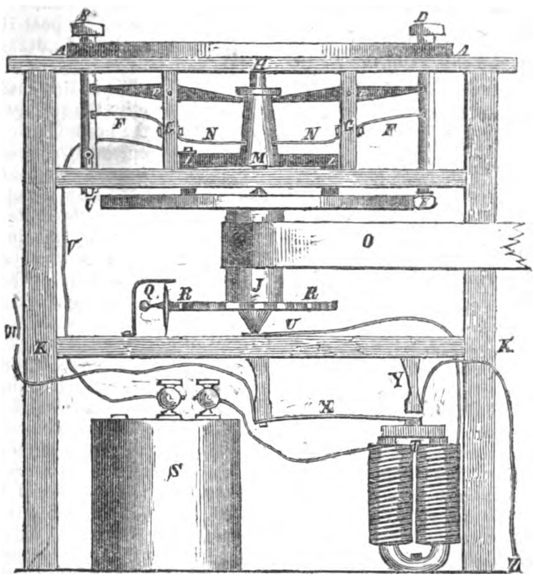
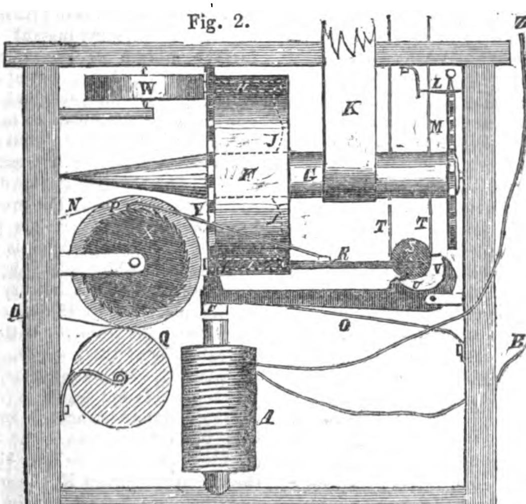


Fig. 2.



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LETTER PRINTING ELECTRO-MAGNETIC TELEGRAPH.

Professor Morse having, in a letter which we published last week, (p. 251,) given it as his opinion that no electro-telegraphic *printing* machine could be devised which could transmit intelligence more rapidly than is now done by the plan of *writing* down the indications of the needles, namely, at the rate (in the United States) of 99 letters per minute, the editors of the *Scientific American* have been induced to publish the following account of an apparatus of their own invention, by which they say—"we shall boldly attempt to show that we can print 250 letters per minute—much faster than any man can write—by the electro-magnetic telegraph, and by a single wire."

Description.

In arranging the several parts of this machinery, it has been our object to render conspicuous the connection of each part, rather than to show the most favourable positions and proportions of each. The most essential principle embraced in this invention, is a peculiar method of measuring accurately very small sections of time: and this is done by a minute verge, ball, or balance, and spring so constructed as to beat 60 vibrations per second, by a verge which has 28 teeth, and consequently revolves 130 times per minute. Without stopping to give a more particular description of this escapement, we shall proceed to describe the other parts of the machinery of fig. 1. On the cap or head of the frame AA, is a horizontal circular dial, near the periphery of which are arranged in circular order twenty-eight vertical and depressible metallic pins, with flat circular heads, two only of which, BC and DE, are represented. These are called keys, on account of their resemblance to keys of musical instruments. The 28 key-heads contain the 26 letters of the alphabet, a star, and one blank. These key-heads are ordinarily elevated about a quarter of an inch above the dial, being held up to that position by the springs FF, which are attached to the post G, between the keys and the centre-post H. The bottom of each key passes through another parallel circular plate a few inches below the dial; and to the side of each key, near the bottom, is attached a thin spring, IC, with a small hook or catch near the bottom, so arranged that when the key is depressed, the catch springs out from the key, and taking to the under side of the plate, prevents the return of the key till relieved from this restraint. Immediately below the plate is a horizontal stop wheel, CE, mounted on a central shaft, J, which is supported by the cross bar, KK. This wheel has 28 arms, or 28 apertures through its disc, and is ordinarily restrained from motion by two branches or prongs, LL, which project from a hollow central shaft, M, which occasionally slides vertically upon the centre post H; the branches forming an angle at L, descend through the plate and into the interstices of the stop-wheel CE. The sliding shaft, N, is slightly pressed down by the springs NN, which are attached to the posts G; and the springs F and N are connected together by screw bolts, so as to form a metallic connection between the keys and the stop-wheel; they all being made of brass or other metal: and the stop-wheel is occasionally put in motion by the belt O (or by gear work if preferred), which is driven by a wheel, which is impelled by a weight or spring, and has a constant tendency to move when unrestrained. A series of horizontal levers, PP, are mounted centrally on the posts G, and extend from the keys to the sliding shaft. A projection called the *stop* (shown at E) is attached to the periphery of the stop-wheel: and when any one of the keys is depressed, the sliding shaft, with its branches, are elevated by the levers, and the stop-wheel being thus liberated, is put in motion till the stop strikes against the bottom of the catch-spring of the depressed key, whereby the key is instantly elevated to its ordinary position; and if no other key is depressed, the branches descend at the same instant, and prevent the further motion of the wheel until again elevated by the depression of a key. Thus it will be seen that the operator having depressed one key, is not required to hold it down, nor to wait for the stop to strike it before another is depressed; but may proceed and depress any number in the direction of the motion of the wheel, but must not overtake or pass over the stop in its progress. The motion of the stop wheel is regulated by a scapement Q which plays upon the scapement wheel R R. A battery S, and magnet T, are attached to the machine; and the circuit extends from the battery through the helical coils of the magnet, and thence viâ the plate U, which supports the centre shaft, the stop-wheel and branches (or key, springs, sliding shaft and branches), and thence by the wire V, to the battery. The main telegraph circuit is supposed to pass viâ the wire W, the armature spring X, the metallic stud Y, and the wire Z. It will be seen that the battery circuit is ordinarily closed, and that, consequently, the armature T is kept in

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contact with the magnet, whereby the telegraph circuit is broken between X and Y. But at the instant that the battery circuit is broken by the depression of a key, the telegraph circuit is closed by the force of the spring X, and continues closed till the stop comes in contact with the depressed key. This machine is for making a telegraphic communication; but the machine for receiving and registering the same at another station, is represented in figure 2.

Explanation of Figure 2.—The telegraph circuit passes through this machine, being received by the wire Z, and passing through the coil of the magnet A, passes off by the wire B. The electric current in the telegraph circuit is supposed to be suspended, and consequently the armature C is elevated from the magnet by the spring D applied to the armature helve. To the upper side of this helve, immediately over the armature, is attached a wedge-shaped projection E, which is also denominated a stop, because it stops the motion of the cylinder F, by coming in contact with a series of 28 teeth or cogs which project from the periphery of the cylinder. These teeth, as well as the stop, are wedge-shaped, and being sharp at the ends, the stop when it rises is very certain to pass between some two of the teeth. The type cylinder is about 2 inches in diameter, mounted on a horizontal shaft G, and contains 28 types, two only of which are represented by the dotted lines H and I; these types are arranged circularly, just inside the periphery of the cylinder, and with sufficient space between them for the arms to connect the periphery to the shaft. A wire spring represented by dotted lines J J, extends from the shaft to each of the types, and serves to return it to its position when it has been pressed forward. The cylinder, when not restrained by the stop, is put in motion by a belt K, which communicates with another wheel impelled by a weight or spring. The motion of the cylinder is regulated by means of a verge L, which plays into a scapement wheel M, which has 28 teeth, and revolves at the rate of 130 times per minute. The strip of paper N O, is drawn from a roll not represented, and passes over the register, roller P, passing between that and the friction roller Q. A horizontal punch R, is attached to a pivot at the end of the punch-shaft S, a little below the centre, and extends to the type cylinder and nearly in contact with the head or blank end of the types. (This punch may be connected to a central crank, between the bearings of the punch-shaft.) This shaft, when not restrained, is put in quick motion by means of the belt T T, which connects with a wheel driven by a weight or spring. This punch-shaft is restrained by an elastic hook U, which takes to a horn projecting from the helve of the armature; and when released from this horn by the depression of the armature, it is restrained by another horn V, which takes to a tooth projecting from the side of the horn V. An ink-roller W, is mounted in front of the types, and distributes a very soft printing ink to the faces thereof as they pass around. A ratchet X, is attached to the end of the register roller, and a hook spring Y, projects forward from a cross-bar which is attached to the punch at R, and takes to the teeth of the ratchet near P. We shall now describe its operation:—When a key of fig. 1 is depressed, the telegraph circuit is closed as before described, and at the same instant the armature of fig. 2 is attracted to the magnet, and the type cylinder is put in motion with a velocity precisely equal to that of the stop-wheel, fig. 1. When the stop strikes the key, the telegraph circuit being broken, the stop of fig. 2 stops the type cylinder, and the punch-shaft being liberated, revolves at the same instant, by which the punch forces one of the types against the paper, and the spring hook taking to the teeth of the ratchet draws forward the register roller with the paper, and the punch-shaft is stopped by the hook taking to the horn V. It will be understood that the types are so arranged that the punch will invariably project the same letter which is on the depressed key: for by means of the wedge-shape of the stop and the teeth, any variation of the motion of the scapement wheels of the two machines, less than half a tooth in a single revolution, will be adjusted when the wheels stop. The type which answers to the blank key, is a blank too short to reach the paper, and is used to space between the letters. The star is used to designate the letters which are used for numerals; also interrogation: and when placed after a space, it signifies a change or a final close of the subject. The types are made of wood and very light: and it is important that the inertia of the stop-wheel and the type cylinder should be exactly equal, that equal times may be occupied in moving equal distances: but if any error occurs, the attendant will readily right it. We shall put these machines in progress of construction immediately.—Ed. Sci. Amer.

COMBINED AIR, GAS, AND STEAM GENERATOR.

Sir,—In your last month's number I perceive some remarks upon an apparently new idea of Mr. A. Gordon concerning a fumigator that he appears to

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be the inventor of, the perusal of which has induced me to send you the accompanying sketch of a somewhat similar "generator," which I have had by me for more than a year. But before we proceed to explain this curious-looking affair, I think a few lines upon its general design will not here be out of place.

Heat is the principal and primary motive cause in the creation (if I may so term it) of power; which power, through the medium of our steam-engines, &c., is made available as a propeller in driving machinery, and other useful purposes. The general effect of heat is to enlarge or expand bodies, either fluid or solid, by insinuating itself between the particles constituting these bodies, and driving them further apart, while the tendency that such bodies have to be enlarged or expanded by the application of heat, demonstrates their capabilities as media for the generation of mechanical power. The effect of the action of heat upon combustible and decomposible matter may be seen at gas works, for example, by comparing the contents of the coal retort with those of the gas reservoir generated therefrom. Atmospheric air is also alike subject to an extensive expansion by the application of heat, and is therefore capable of generating mechanical power. Of this, as well as the gas-working engine, we have many examples in this country, which have been the subject of several very ingenious patents, and by actual experience have been proved capable of driving machinery with tolerably good effect, though not so economically and effectively as by steam in the steam-engine. Now let us for a moment examine the simple operation of a steam boiler and engine. The water in the boiler, by the application of heat, assumes the aeriform state, which is the result of a very extensive expansion, and this expansion is the primary force which works the engine. But what means do we use to obtain that heat whereby we evaporate the water in the boiler? Combustible matter, when in sufficient quantities, and once set a-going, spontaneously gives out heat—(whence that heat comes, it is not our present object to explain)—and during that combustion its bulk is infinitely increased, in the form of smoke, &c., or the gases which pass off from the fire. Now let us look at the fire beneath the boiler of an engine. Whence comes that current of matter which is continually ascending the flue? Simply from the coal, and the atmospheric air admitted through the grate to supply combustion; but if we compare the bulk of the cold air and the fuel before it enters the fire, we find it bears very little comparison to the bulk of the gases escaping up the chimney—very plainly illustrating that there is here a very enormous expansion, which is totally neglected, and of no avail as a generator of power in the steam-engine. Now here arises a very natural question—Cannot this expansion of the atmospheric air, and of the combustible matter composing the fire, be rendered available, as well as that of the water in the boiler, to the propulsion of the moving parts of the steam-engine? And, to effect this, cannot we have the fire enclosed within the boiler? And let the products arising from combustion pass along with the steam, to supply the engine, as also the atmospheric air required for the combustion of the fuel; and let us thus form, in the place of a steam boiler, a combined steam, air, and gas generator, and thereby render the expansion of the fuel resulting from combustion and decomposition, and that of the air passing through the fire, together with the expansion of the water or generation of steam, available in driving the necessary machinery.

In the accompanying sketch I have endeavoured to represent a "generator" upon this principle. A is the fire in a state of combustion upon the grate-bars B; C, the air-tight door, whence the fuel is supplied when the self-feeding cylinder beneath it is empty; D, the water surrounding the fire-box, over which pass the gases and hot air arising from the fire, on their passage down between the two inner cylinders, and up through the water E into the upper part of the generator. The air necessary for combustion is supplied from an air-pump by the pipe F, worked by the engine. The pipe G also supplies the necessary water for evaporation. By this arrangement it will be observed that the gases in the fire are of the same density as those of the other parts of the boiler; therefore the fire-box is subject to no pressure, and can by this means be made proportionably thin. The hot air and gases arising from the fire are made to pass through the water in minute bubbles, and thus their tempera-

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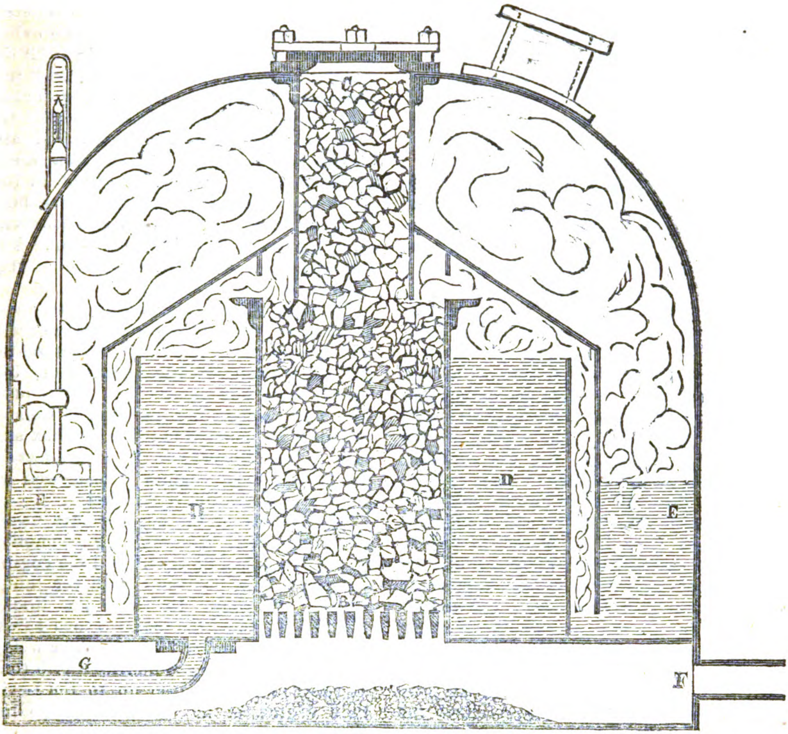

ture cannot be much greater than the water through which they pass.

And now, Mr. Editor, I must thank you for the space you have allowed me in your pages to represent an idea which, as far as my knowledge extends, is entirely new. It is unquestionably fraught with many difficulties; yet, with all, (deducting fifty per cent. for its novelty,) is not still left entirely useless. But this I will leave to the honest judgment of your numerous readers.

It may be objected that there will be a great amount of power consumed to force air into the fire; but I would reply, that the power derived from the expansion of that air will more than counteract the amount of power consumed to work the air-pump. Again, it may be objected that the particles of the fuel will pass along with the current into the engine; but this may be avoided by decreasing the velocity of that current and promoting slow combustion. The difficulty of supplying the fire with fuel, or making it self-acting, may also be overcome by a little ingenuity. And as for the water getting into the fire, if the "generator" be properly constructed, there need not be any fear.

W. E. Carrett.

Leeds, March 9, 1847.

TWENTY-ONE YEARS' RETROSPECT OF THE RAILWAY SYSTEM.

The greatest speed of Trevithick's engine was five miles an hour. The ordinary speed of George Stephenson's Killingworth engine, in 1814, was four miles an hour. In 1825, Mr. Nicholas Wood, in his work on railways, takes the standard at six miles an hour, drawing 40 tons on a level, and so confident was he that he had gauged the power of the locomotive, that he thinks it right to say, "that nothing could do more harm towards the adoption of railroads than the promulgation of such nonsense, as that we shall see locomotive engines travelling at the rate of 12, 16, 18, and 20 miles an hour." The promulgator of such nonsense was George Stephenson. In 1829 ; was

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estimated that at 15 miles an hour the gross load was nine tons and a half, and the net load very little, and that, therefore, high speed if attainable was practically useless. Before the end of that year George Stephenson got with the Rocket a speed of 29½ miles per hour, carrying a net load of 9¼ tons. In 1831 his engines were able to draw 90 tons on a level at 20 miles an hour.

When the speed of the locomotive was set beyond question, prejudice then took alarm about the safety, and a very strong stand has, from time to time, been made for a limitation of speed. Within the last seven years the London and Birmingham directors considered 20 miles an hour was enough, and had they been free from competition and supported by public opinion, they would, no doubt, have adhered to that rate, from the conscientious conviction that a higher speed was incompatible with economy and safety. The vigour of the broad-gauge advocates, and the necessity for proving the capabilities of their system, have led them to push on the march of improvement with energy, and the narrow gauge lines have been forced to follow. Thus the enterprise of directors and the ingenuity of engineers have been kept on the stretch to carry on the rivalry; and we consider the broad gauge as valuable, if on no other ground, that it has tripled the working power of the locomotive, and given us 60 miles an hour, where we should have been lingering at 20. We recollect the smile of unbelief, when it was announced that Brunel had run a locomotive at the rate of a mile a minute, and when at length it was known to be true, it was said that it was not safe, and would never do, and yet it has since then been made a working speed.

Thirty miles an hour was thought progress — an express at 35 miles an hour seemed to have reached the furthest limits —but, in 1846, Brunel succeeded in working the express to Bristol in two hours and a half, and to Exeter in four hours. Mr. M'Connell, the new locomotive superintendent of the London and North Western, has determined that the narrow gauge shall not be behind, and he has an engine building to carry the express train between London and Birmingham in two hours, and we believe he will do it.

Trevithick's greatest net load was 10 tons, that of Stephenson's first engine 30 tons. In 1825 the net load was 40 tons, in 1831, 90 tons, now 1,200 tons.

These greater effects of the locomotive have been caused by an increase in the size of the parts, and a greater effective power. Trevithick's cylinder was 8 ins. in diameter, and he had only one cylinder. Brunton's cylinder was 6 ins. diameter. Stephenson's first locomotive had two cylinders, each of 8 ins. diameter. In 1829 the Rocket had two cylinders, each of 8 ins. diameter. The Sans Pareil had two cylinders, each of 7 ins. in diameter; in 1831 the cylinders were enlarged to 10 ins. and 12 ins. diameter. In 1832 the Sampson, a powerful engine, had cylinders of 14 ins. diameter. Since then cylinders have been increased to 15 ins. and 18 ins. diameter, as in the Great Western locomotive. The immense increase of power may be inferred from these measurements.

In 1829 the heating surface was about 100 square feet. It was soon increased to 200 square feet, and then to 300 square feet, afterwards to 400 square feet, 500 square feet, 600 square feet, 800 square feet, 1,000 square feet, and Mr. M'Connell promises to increase it. The fire-box surface in the Rocket was 20 square feet, in the broad-gauge engines it has been increased to above 100 square feet.

The weights of the engines have necessarily increased. Brunton's leg locomotive, in 1813, weighed 2¼ tons. In 1825 engines weighed 5 tons, but some with the tender weighed 10 tons. In 1829, the Rocket weighed 4¼ tons, the tender 3 tons 4 cwt., the total being under 7½ tons. The weight of the engine has been increased to 8 tons, 10 tons, 12 tons, and so up to the Leviathan engine of 29 tons, on the Great Western.

The rails have become heavier with the weights of the engines. On the Stockton and Darlington, in 1821, they were not more than 28 lbs. to the yard. On the Liverpool and Manchester, in 1829, they were laid down at 35 lbs. to the yard. They were successively increased to 50 lbs. and 65 lbs. The London and Birmingham was originally intended for rails of 64 lbs. to the yard; but on Mr. Barlow's report, they were increased to 75 lbs.; since then rails of 85 lbs. to the yard have been laid down on some lines.

On the other hand, the consumption of fuel has diminished. Before 1829, the consumption of fuel was about 5 lbs. to carry one ton a mile, in that year George Stephenson reduced it to 2·41 lbs. of coke. It would scarcely be credited, that it can now be brought to less than a quarter of a pound per ton per mile.

The gradients overcome have been steeper. Less than ten years ago, a gradient of 1 in 105 was considered as impassable, except by means of a stationary engine. A gradient of 1 in 37 can now be managed with the locomotive.

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The effect of these enormous changes has been to give the country a very great saving in the charges for carrying, to say nothing about the time. The rates for goods have in many cases been reduced one-half, in some cases even to a greater extent; while there is a tendency in the progress of the railway system to a greater reduction.

To show, in a clearer light, the difference between railways and locomotives in 1804, 1829, and 1846, we have drawn up the following comparisons:

1804	weight of rails	28 lbs.,	weight of engine	——
1829	,,	35 lbs.	,,	4¼ tons
1846	,,	85 lbs.	,,	29 tons
		miles.		miles.
1804	highest speed	5 per hr.,	working speed	2½
1829	,,	29½	,,	10
1846	,,	75	,,	55
		ins.		tons.
1804	diameter of cylinder	8,	greatest net load	9
1829	,,	8	,,	40
1846	,,	18	,,	1200
1829	fire-box surface	20 sq. ft.,	heating do.	117 ft.
1846	,,	108	,,	1000 ,,

The great object in these remarks has been to show the progressive nature of the railway system, the danger which arises from rash conclusions, and the necessity for caution in prejudging the course of improvement. To sanction novelties may be injurious; but not to prejudge novelties is only prudence. The former savours of quackery, to put down novel inventions on the score of prejudice betokens ignorance, and the latter is the more prejudicial. If quackery be allowed to go on in its career, it is sure to expose itself: but to check a new invention, because new, can do no good and may lead to very great public loss.

[From an able and most instructive article under the head of "Railway Prejudices and Railway Progress," in Mr. Hyde Clarke's monthly *Railway Register* for February.]

CHAPTERS ON ANALYTICAL GEOMETRY. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from page 248.)

Sir,—I must beg of your readers to erase the words "*Notes on the Theory of Algebraic Equations*" from the heading of my paper at pages 245—248 of your last number (1231). The title of that article should have been "*Chapters on Analytical Geometry*," and I believe that my manuscript was so headed.*

I am, Sir, yours, &c.,

JAMES COCKLE.

2, Church-yard-court, Temple,
March 15, 1847.

* The error, as our learned friend states, was entirely one of the press. We much regret that it should have occurred.—ED. M. M.

CHAP. III.—*On the Hyperboloid of one Sheet.*

SECTION 1.—*Its Critical Planes.* The equation of the hyperboloid of one sheet, referred to its principal planes, is

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1\,;$$

a, b, and c being the axes of the surface, and the origin its centre. Let this surface be intersected by the plane whose equation is

$$px+qy+rz+s=0,$$

in two parallel straight lines. The conditions to be satisfied are

$$r=\frac{1}{c}\sqrt{a^2p^2+b^2q^2},\ \text{and}\ s=0\,;$$

the last condition shows that all planes which meet the surface in parallel straight lines pass through the centre. Hence *the hyperboloid of one sheet cannot be intersected in parallel straight lines by more than one plane parallel to the same plane.*

When $r=0$ the conditions require that we should have $p=0$, $q=0$, for we are confined to real values of p, q, and r. Our result consequently becomes nugatory. In fact there are no rectilinear intersections of any kind with planes parallel to that of $x\,y$. Such sections are all ellipses.

The *system of two planes* and the *cylinder* may, if intersected in parallel straight lines by any plane, be similarly intersected by an indefinite number of other planes parallel to the former one. The *cone*, or the *single plane*, are evidently incapable of being intersected by a plane in parallel straight lines,—which is also the case as we shall hereafter see with the *hyperbolic paraboloid*. Hence, *if a surface of the second degree, being intersected by a plane in two parallel straight lines, admit of no such intersections with any plane parallel to the former one, the surface is the hyperboloid of one sheet.*

SECTION 2.—*Other Intersecting Planes.* When the hyperboloid of one sheet meets a plane in two intersecting lines, we may at once find another plane parallel to the first, which shall cut the surface in two intersecting straight lines parallel to the former two. For, draw a straight line from the intersection of the first two lines to the centre, and produce it till it meets the surface. Through the

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point where it meets the surface, draw a plane parallel to the first plane. Then the symmetry of the surface with respect to the centre shows that the second plane will meet it in intersecting straight lines parallel to the former two.

Combining this with a proposition given in my second "*Chapter on Analytical Geometry*," (*vid. sup.* p. 246, 2nd column, 3rd paragraph,) and with the fact that the hyperboloid of one sheet admits of rectilinear intersections (parallel or otherwise) with two, at least, of the co-ordinate planes, we arrive at the following:

The hyperboloid of one sheet has two rectilinear intersections with either (1) *only one or* (2) *only two planes parallel to a co-ordinate plane;—the intersections being parallel in the former case, but not so in the latter.*

And, conversely,

When a surface of the second degree has either (1) *two parallel rectilinear intersections, with one and only one plane parallel to a co-ordinate plane, or* (2) *two non-parallel rectilinear intersections, with two, and only two planes parallel to a co-ordinate plane, the surface is the hyperboloid of one sheet.*

SECTION 3.—*Examples.* Besides the examples of the determination of the nature of surfaces of the second degree by means of this principle, which I have given at p. 257 of vol. II. of the *Mathematician*, and p. 247 of the last number of this work, the following may be acceptable to your readers.

Ex. (a).—What is the surface represented by the equation

$$yz+zx+xy-x-2y-3z+2+a=0$$

when a is positive? (Leroy, *Analyse appliquée à la Géo.*, &c., p. 160, Paris, 1835.)

Here, in the same manner as at p. 247 of this volume, we obtain

$$a\gamma=1, \qquad \beta\gamma=z-2,$$
$$a\delta=z-1, \qquad \beta\delta=-3z+2+a$$

$$\text{and } \frac{\delta}{\gamma}=z-1=\frac{-3z+2+a}{z-2}$$

whence $z^2=a$ or $z=\pm\sqrt{a}$, and the surface is the *hyperboloid of one sheet.*

Ex. (β).—Determine the surface whose equation is

$$A^2x^2+B^2y^2+C^2z^2-2BCyz-2\,ACxz-2\,ABxy-1=0.$$

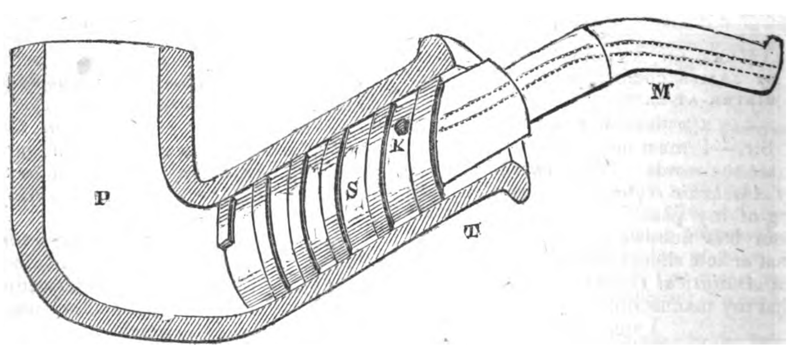
Proceeding as at p. 257 of No. 5 of the *Mathematician*, we reduce this to

$$\left\{ Ax-By-Cz \right\}^2-4\,BC\,yz-1=0:$$

and if $z=0$, we see that the surface has two parallel intersections with the plane of xy, and has no rectilinear intersections with any other plane parallel to that of xy. The surface is consequently the *hyperboloid of one sheet*, as stated at page 283 of vol. II. of the *Mathematician.*

(*To be continued.*)

IMPROVEMENT IN SMOKING-PIPES.



Sir,—It is always desirable to combine in the structure of a pipe the following properties—a portable, convenient size, and the largest possible passage from the tobacco to the mouth-piece. For this purpose, the tubes are often made in a twisted form; but the difficulty of cleaning any complicated tube is felt by all

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who have to do it. The prefixed sketch represents a construction which ensures a long passage for the smoke, occupies little room, is easily made, and readily cleaned.

P is the bowl of the pipe; T, the shank, longer than usual; M, the mouthpiece, at the end of which is the solid cylinder, S; round this passes a screw-formed projection, and when this is inserted into the shank, the smoke passes only by the square spiral aperture round the cylinder, and finally through the hole K by the dotted lines to the mouth. The cylinder may be made of glass, china, wood, or any other suitable substance, and can be removed and cleaned with the greatest ease.

Perhaps the shank should be lined with cork, which would ensure the joint being air-tight.

J. M.

JEANS'S TRIGONOMETRY.*

Amidst the dreariness of the interminable formulæ and the prairies of symbols, with which our recent works on trigonometry are deformed, there is something which is refreshing to the eye, and productive of repose to the mind, in contemplating the pages of any work in which there appears a design to apply these formulæ to any practical purpose whatever. We had intended to say something on this head in our *Miscellanea Mathematica:* but we have really been deterred from our task by our utter inability to point out a single and separate work which we could conscientiously recommend to our readers. The present work removes our difficulty: but we think it more fair and courteous towards the author to express our estimate of his work in the shape of a formal notice, than to merely refer to it in the shape of a subordinate topic in a series of professional papers.

No kind of literature is so imperfect as our school and elementary; and, of this, none so imperfect as the elementary mathematical. Many causes (some of which we shall hereafter enumerate) contribute to this; and such, we fear, must be the case for a considerable time to come. The experienced teacher is seldom able to find time to compose books; and, indeed, comparatively few of the great mass of schoolmasters are competent to the task, either as regards ability or acquirements. Nor is it by a heterogeneous mass of the most ignorant and presumptuous of that Order forming themselves into a "College of Preceptors" that the nuisance is likely to be abated. The disgusting mendacity of this self-constituted body of dictators in education may do incalculable mischief; whilst we see no one element of it that is calculated to mollify the character of its firebrand-mission. Amongst its pretensions, are those of supplying from amongst the holders of their "guinea-diploma" teachers for everybody; and writers of books on every subject! It even out-Herods the far-famed "Literarium" of the Strand.

We do, however, now and then get a book from men of eminent science and great experience in tuition. We have already noticed Mr. Tate's works: and we have much satisfaction in placing, if possible, as still higher, those of Mr. Jeans. To such books as these the renovation of our educational systems must be indebted. It is not to the wild schemes of drill-serjeantism that the public must look; but to intelligible elementary books—books that can only be written by men of profound science, and yet men who *can afford* to merge the scientific in the useful—and to sacrifice all display to practical and efficient instruction.

In the work before us, the industrious and intelligent reader will find trigonometry rendered as simple as, in our opinion, it can ever be rendered,—both as regards its theory and its numerical operations. The explanations are clearly given, and the reasons accurately developed; whilst there is a total freedom from all affected cleverness of authorship. The gradual evolution of principles, and the clear expression of the *ideas* of the subject, which characterise this work, invest it with an agreeableness that belongs to few elementary treatises on mathematics.

* Plane and Spherical Trigonometry; parts 1, 2. By H. W. JEANS, F.R.A.S., Royal Naval College; formerly Mathematical Master in the Royal Military academy Woolwich, 2 vols. 12mo. Longmans.

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It would be useless to give any analysis of the contents of the work in this place; and in fact the excellence of the book is in no way dependent on the table of contents—nor yet on any great peculiarity of a mere mathematical kind. The models for working are very neat and methodical; the rules are well expressed, and investigated with rigorous simplicity; and the examples are very numerous and judiciously chosen. Besides, to the best of our knowledge, a great number of the examples are original—a feature not often seen in works of this kind.

On the whole, then, we can recommend this work to those of our readers to whom trigonometry is new, or by whom it has been only partially studied; and we are sure that they will find little difficulty, provided they exercise only ordinary perseverance in mastering (unaided otherwise) this branch of knowledge—a branch of knowledge, be it remembered, whose importance is inferior to that of no mathematical one to the engineer, architect, builder, and artizan.

DESCRIPTION OF SEVERAL IMPROVED ELECTRO-MAGNETIC TELEGRAPHIC INSTRUMENTS, INVENTED BY MR. WILLIAM HENRY FRENCH, LATE TUTOR TO THE ELECTRIC TELEGRAPH COMPANY, CARDIFF, GLAMORGANSHIRE.

First Instrument—Electro-Magnetic Current Deflector.

The base of this apparatus, of which fig. 1 is a plan, is composed of two circular blocks of wood; the smaller or inner circle is let in flush to the surface of the outer one, in the form of a swivel. The outer circle is divided into twenty-six equal parts, and in each part a strip of brass is let in flush to the surface from the outer to the inner circumference. In the top part, consisting of fourteen divisions, there are eight terminals, marked A, B, C, D, E, F, G, H, screwed in every alternate two, by which a direct communication is made with the line wires. The first two on the left, A and B, are in connection with the two branch wires No. 1 *b* and No. 2 *b*; the next two are blanks. The following two, C and D, are in connection with the up-wires No. 1 and No. 2; the next two blanks. E and F are in connection with No. 1 and No. 2 down-wires; the next two are blanks. And the last two, G and H, are also in connection with the branch wires. Terminals, marked 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, are fixed in all the remaining twelve divisions, on the lower part of the apparatus, by which they are connected to the three instruments fixed in the same room.

The swivel, or disc of wood, is divided into eight semicircular lines of brass, marked 1, 2, 3, 4, 5, 6, 7, 8, let in flush with the surface. Eight small springs, marked T 1 and T 2, are fastened to the extreme ends of the four outer semicircular lines marked 1, 2, 3, 4, which lines form two broken circles. The springs T 1 press on the line terminals;—the springs T 2 press on the instrument terminals. The remaining four semicircular lines, marked 5, 6, 7, 8, are let in parallel with each other. A handle is placed in the centre, by which the swivel is moved in three directions to which it points. The axis of the handle is continued through the outer block of wood to the back of the apparatus, there terminating in a screw, to which the earth or circuit wire is connected. Two strips of brass in connection with the handle are also let into the surface of the swivel, to complete the earth connection when required.

The metallic connection of the outer circle commences at one of these springs, resting on the brass strip of the terminal A of No. 1 *b* branch wire, proceeding through the semicircular line marked 1 to the right, and terminating in a spring resting on the ninth lower divisional strip at the terminal 9, to which one end of the left-hand coil of the right-hand instrument should be connected. The other end should also be connected to terminal 10 of the next or tenth lower divisional strip, proceeding from thence by a spring to the remaining portion of the outer circular line, and terminating at the right by another spring resting on the brass strip of the terminal C, in connection with No. 1 up-wire. The next circular line, marked 2, commences at a spring, which rests on the brass strip of terminal B, connected to No. 2 *b* branch wires, which proceed to the right, terminating in a spring which rests on the eleventh lower division, which is connected by terminal 11 to one end of the right-hand coil, the other end being connected by terminal 12 to the strip of brass of the next division, on which rests the spring

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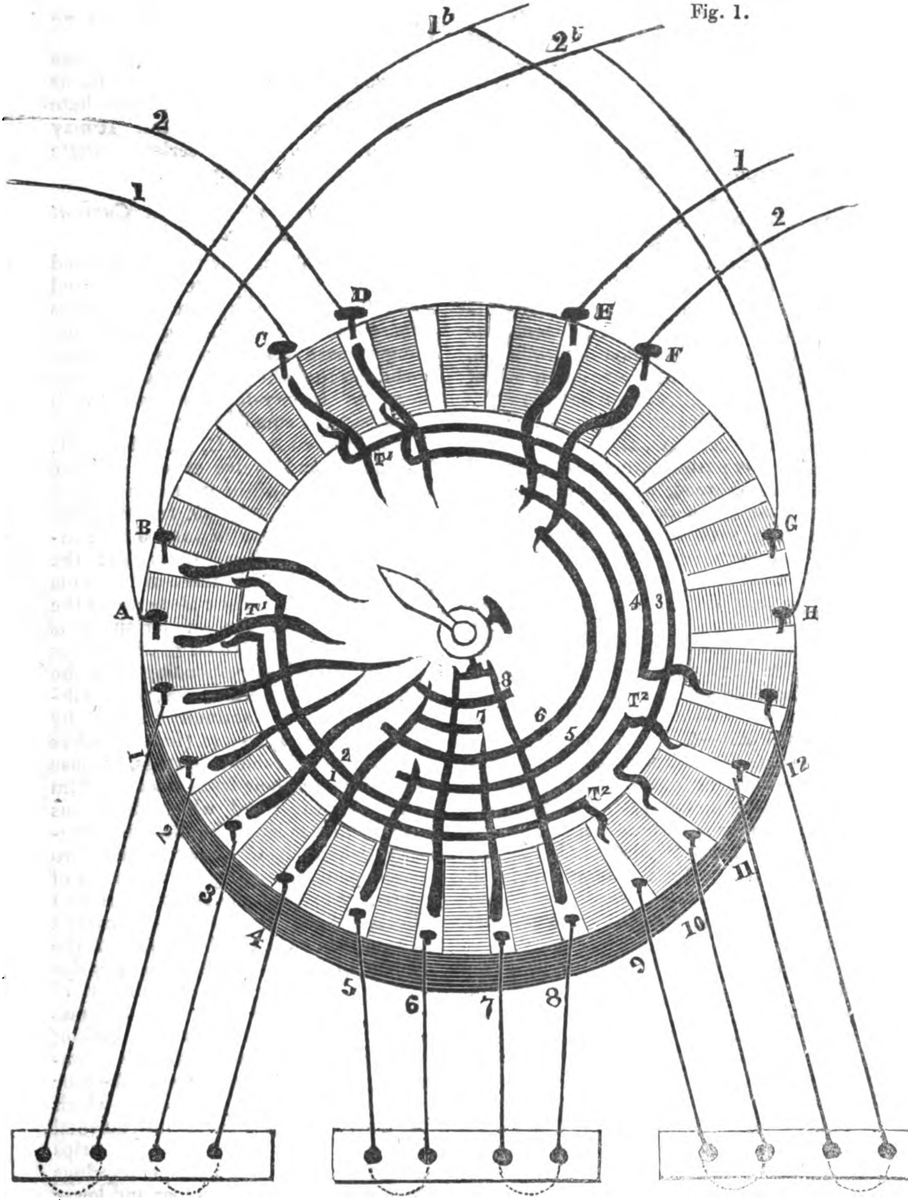
of the remaining portion of the same circular line, terminating at the spring of terminal D, in connection with No. 2 up-wire. By this arrangement, the through circuit can be completed in three directions; but in order to keep good the

Fig. 1.



branch circuit, fourteen larger springs are fastened to the terminals A, B, C, D, E, F, and 1, 2, 3, 4, 5, 6, 7, and 8, which sometimes rest on wood, and at other times rest on five distinct portions of the remaining four semicircular lines.

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Thus the terminal E is connected to No. 1 down-wire by the spring pressing on the fifth or next semicircular line, which proceeds to the left, and upon which would press another spring proceeding from the lower terminal 5, which should be connected to one of the left-hand coils of the middle instrument; the other end should be connected to terminal 6, the spring of which leads to the centre strips in connection with the handle. The spring of No. 2 down-wire presses on the next semicircular strip, marked 6, which leads towards the left, and terminates opposite terminal 3; but the connection is made by the spring of terminal 7, to which is connected one end of the right-hand coil of the middle instrument, the other end being connected to terminal 8, the spring of which also rests on one of the strips leading from the handle.

The remaining eight springs connected to terminals A, B, C, D, and 1, 2, 3, 4, while in this position would be insulated by resting on wood, which is a non-conductor, but would be thrown in metallic connection with the circular strips by the two other changes of the apparatus, which would also insulate some of the springs that are at present in metallic contact.

If the branch lines are required to be thrown in connection with the up-lines, the handle should point towards the left; the down-line would be then thrown into a short circuit—(see engraving.)

If the up-line is required to be in connection with the down-line, the handle should point upwards; the branch line would then be in a short circuit; but if the branch line is required to be thrown in connection with the down-line, the handle should point towards the right; the up-line would then be in a short circuit.

By the system now in use, all communications intended for the branch would not only be seen beyond the branch, which is calculated to prevent other communications, but there is considerable delay caused by the necessity of having another person at the junction of the branch line to re-transmit the signals by a separate instrument in connection with the branch. Again, the person may not be able to attend to the branch signals in consequence of being engaged with the starting of a train, or some other important signals. Supposing the branch to be not very far distant, and the object of the communication to be to apprise the starting of a special train, or from a person leaving by train in a few moments, how could they wait for an answer?

By the present apparatus all these inconveniences are avoided. It affords the means of obtaining an immediate answer under all circumstances. It may be used for two separate series of single wire instruments if required.

Second Instrument—Another Current Deflector.

The same object may be also attained by the simplified apparatus represented in fig. 2, which is composed of two pieces of hard wood of a longitudinal form, one being of narrower dimensions, and made to slide in the other. In the outer piece there are twenty-four terminals with plates let in at equal distances; twelve at the top marked A, B, C, D, E, F, G, H, I, J, K, L, and twelve exactly opposite at the lower part of the apparatus marked 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. The upper terminals are in immediate connection with the line wires, and the lower terminals with three instruments connected below. The slide between the upper and lower row of terminals is also inlaid with twelve strips of brass at equal distances, corresponding with the terminal plates on either side, and forming a metallic continuity either by springs or friction rollers, (friction rollers are always preferable to springs, because the springs by their friction leave a film of brass on the wood, which film forms a conducting medium for the fluid, especially when made between the two nearest points, it being the property of electricity to take the shortest circuit.) The springs of the four strips marked E press only on the bottom, and the springs of the remaining eight strips marked M press on both rows of terminal plates. A long strip of brass is let in the entire length at the back of the slide to which the earth wire is connected, and is also connected to the four strips marked E, by four screws which rest only on the lower or instrumental terminals; the remaining eight strips marked B and M terminate in two springs each, which rest on the upper and lower terminal plates.

The wires of the main line are connected thus:—The A, or No. 1 up-wire is connected to terminals B and E; the

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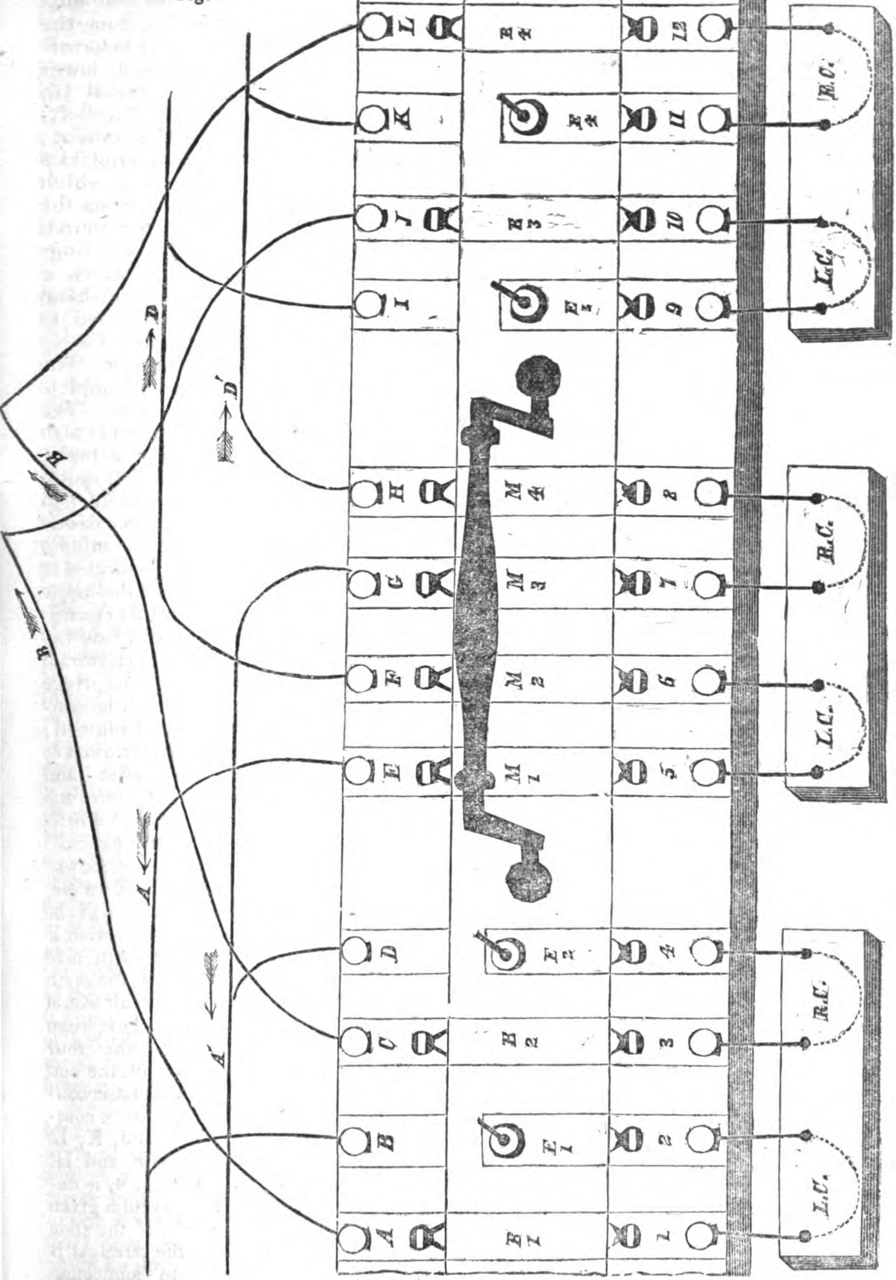
Fig. 2.



D, or No. 1 down-wire to terminals F and I; the A′, or No. 2 up-wire to terminals D and G; the D′, or No. 2 down-wire to terminals H and K. The branch wires are connected as follows:—The B, or No. 1 branch wire to terminals A and J; the B′, or No. 2 branch wires are connected to terminals C L.

A handle is placed in the centre of the slide which spans over the middle strips marked M, for the purpose of changing the direction of the fluid by moving the slide either to the right or left. Care must be taken that the handle is not made to touch any but the earth strips.

To communicate with the up and down-wires by completing the current of the main line, this apparatus should be closed, which would also complete the branch line in a short circuit. The handle would then be between the middle row of terminals.

To communicate with the branch and up-lines, the circuit would be completed between the branch and up-lines by moving the handle to the left-hand row of terminals, which would also complete the down-line in a short circuit.

To communicate with the branch and down-lines, the circuit would be completed between the branch and down-lines by moving the handle to the right-hand row of terminals, which would also complete the up-line in a short circuit.

When this apparatus is closed, the branch communication is made with the two outside instruments in the following manner:—From No. 1 branch-wire to terminal A, through the upper and lower springs of strip B 1, to the terminal No. 1, to which is connected one end of the left-hand coil of the left-hand instrument; the other end is connected to terminal No. 2, through the spring of strip E 1, terminating at the earth wire. And from No. 2 branch wire to terminal C, through the upper and lower springs of strip B 2 to terminal 3, to which is connected one end of the right-hand coil, the other end being connected to terminal 4, through the spring of strip E 2, which also terminates at the earth wire. In this position the branch communication is also made with the right-hand instrument by a divided current.

The signals of this instrument will appear in the reverse direction of the other, which is an advantage. The No. 1 and No. 2 branch-wires are also connected to terminals J and L, from the branch wire No. 1, proceeding to terminal J through the upper and lower springs of strip B 3 to the terminal 10, to which is connected one end of the left-hand coil of the right-hand instrument; the other end is connected to terminal 9 through the spring of strip E 3, which terminates at the earth wire. From the branch wire, No. 2 proceeds to terminal K, through the upper and lower springs of strip B 4 to terminal 12, to which is connected one end of the right-hand coil; the other end being connected to terminal 11, through the spring of strip E 4, terminating at the earth wire. The branch-line circuit is thereby complete through the two outer instruments. The direct or through communication is also made by the main wires. For example, from No. 1 up-wire to terminal E, through the upper and lower springs of M 1 to terminal 5, to which is connected one end of the left-hand coil of the middle instrument; the other end is connected to terminal 6, from thence through the lower and upper springs of strip M 2 to terminal F, to which is connected No. 1 down-wire; and from No. 2 up-wire to terminal G, through the upper and lower springs of M 3 to terminal 7, to which is connected one end of the right-hand coil; the other end is connected to terminal 8, from thence through the lower and upper springs of strip M 4 to terminal H, to which is connected No. 2 down-wire—thus completing the through circuit. Nos. 1 and 2 of the up and down, or main wires, are also connected to terminals B, D, I, and K, but it will be observed that the metallic connection is here broken. In the present position of this apparatus, were it otherwise, the earth wire connected to the short circuit would destroy the through circuit; but when moved either right or left, the four middle strips take the place of the end strips, by which means the metallic connection of B and D, or I and K, is completed, and of E and G with I, J, K, L, with 9, 10, 11, and 12, or F and H, with A, B, C, D, and 1, 2, 3, 4, is destroyed, according to the direction given to the slide. For example, if the slide were moved to the left, the terminal B and D would be thrown in connection

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with the upper and lower springs of strips M 2 and M 4, by which means the through communication would be made by the branch and up-wires. For instance, from the branch wire No. 1 to terminal A, through the upper and lower springs of the strip M 1 to terminal 1, through the left-hand coil of the left-hand instrument to terminal 2, through the lower and upper springs of the strip M 2 to terminal B, proceeding by No. 1 up-wire, and also from the branch wires, No. 2, to terminal C, through the upper and lower springs of strip M 3 to terminal 3, through the right-hand coil to terminal 4, and the lower and upper springs of strip M 4 to terminal D, proceeding by No. 2 up-wire. The other connections of No. 1 and No. 2 up-wires at E and G would be thrown out, and the terminals F and H would be thrown in connection with strips B 3 and B 4, which would connect the instruments of the down-line with the middle instrument. For example, from No. 1 down-wire, through terminal F, and upper and lower springs of strip B 3 to terminal No. 6, through the left-hand coil of the middle instrument to terminal No. 5, up the spring of strip E 3, terminating at the earth wire, and from No. 2 down-wire through terminal H, thence to upper and lower springs of strip B 4 to terminal 8, through the right-hand coil to terminal 7, up the spring of strip E 4, terminating at earth wire, and so also completing the down-line circuit.

If the slide were moved to the right, the terminals I and K would be thrown in connection with strips M 1 and M 3, by which means the through communication would be made by the branch and down-wires. As thus—from the branch wire No. 1 to terminal J, through the upper and lower springs of strip M 2 to terminal 10 through the left-hand coil of the right-hand instrument to terminal 9, through the lower and upper springs of strip M 1 to terminal I, and thence to No. 1 down-wire; and from No. 2 branch wire to terminal L, through the upper and lower springs of strip M 4 to terminal 12, through the right-hand coil to terminal 11, and lower and upper springs of strip M 3 to terminal K, from thence to No. 2 down-wire.

The other connections of No. 1 and No. 2 down-wire, at terminals F and H would be thrown out, and the terminals E and G would be thrown in connection with the springs of B 1 and B 2, which would connect the instrument of the up-line with the middle instrument. As thus—from No. 1 up-wire, through terminal E 1, and upper and lower springs of strip B 1 to terminal 5, through the left-hand coil of the middle instrument to terminal 6 and spring of strip E 1, terminating at the earth wire; and also from No. 2 up-wire to terminal G, through the upper and lower springs of strip B 2 to terminal 7, through the right-hand coil to terminal 8 and spring of strip E 2, terminating at the earth wire—thus also completing the up-line circuit.

In addition to the earth wire in connection with this apparatus, the usual earth wires at the two terminal instruments of the main line, and one at the other end of the branch line should also be made.

This apparatus may also be used for two separate series of single-wire instruments; or a series of single-wire instruments and a series of bells, if required, may be employed by using the No. 1 up, down, and branch wires for bells, and the No. 2 up, down, and branch wires for instruments; or a single-wire apparatus may be made, by adopting the arrangement either of the No. 1 or No. 2 wires; or the number of wires may be increased by making duplicate arrangements.

The letters "L C" in the engraving denote "leading to the left coil;" the letters "R C," "leading to the right coil."

Third Instrument—Improved Electro-Magnetic Bell and Signal Apparatus.

The great uncertainty which has hitherto attended the ringing of alarums by electricity, from the unavoidable variation of the battery power, and of the springs and other mechanical arrangements, is effectually avoided by the simplicity of the present arrangement.

Two electro-magnets are placed half an inch apart with the poles opposite each other, and a keeper freely suspended between them, to the centre of which a bell clapper is fixed, proceeding to the bell above. At the lower part of the keeper a weight is fixed by a screw, by which it is regulated. Should the current be too feeble, the weight can be screwed upwards; if too intense, the weight should be screwed downwards.

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Each electro-magnet is made of two light round boxes, or thin frames of hard wood, in the shape of a cotton reel, with a hole in the centre; one end of each is stopped up with a round piece of soft iron, but in the shape of a horse-shoe; the other end is stopped up with two small round pieces of soft iron, and the aperture of each is filled with iron filings; covered wire is then wound round the wooden frames in the usual way.

As solid iron under the oft-repeated galvanic influence is found to retain its magnetism, instead of resuming its natural state, I think by the use of iron filings instead of soft iron, the electro-magnet would more readily yield to every successive increment of power.

W. H. French.

September 23, 1846.

(*To be continued.*)

THE GUTTA PERCHA PATENTS.—NO. VII.*

Charles Hancock, of Grosvenor-place, artist, for "*certain improvements in the manufacture of gutta percha and its applications, alone and in combination with other substances.*" Patent dated May 15, 1846.

My invention consists, *Firstly*, in certain improved methods of preparing gutta percha for manufacturing purposes. Gutta percha as it is imported into this country frequently possesses great acidity, with a fœtid or unpleasant smell, and is generally mixed with other impurities from which it ought to be cleansed before it can be beneficially applied in the production of many articles of manufacture.

For the purpose of cleansing gutta percha, it is better that it should first be reduced into small pieces by means of saws, knives, or any other means usually adopted for that purpose; and the cutting of lumps of gutta percha will be very much facilitated by first steeping them in hot water until they are softened.

The gutta percha having been cut into small thin pieces, (the smaller and thinner the better,) so as to expose a large extent of surface to the action of the liquid into which it is to be thrown, is then to be immersed in an alkaline solution, or in a solution of chloride of some alkali or earth, in which the gutta percha must remain until the acid and fœtid impurities which it contains have been got rid of, or materially diminished, for which purpose it will generally require to be kept in the liquor from about one to four hours, according to the degree of impurity of the article at the time it is thrown into the liquor.

I prefer using common soda or potash for forming an alkaline solution, on account of the cheapness of these articles; but if these alkalies are used in a more caustic state, they will act more quickly and with greater energy.

I prefer also to use the chloride of lime to any of the other chlorides, in consequence of that article being cheaper. The solution is made of the strength that I prefer, by dissolving about one pound of alkali or chloride with ten gallons of water. If it is desired still further to diminish the acidity or smell of gutta percha, it may in the first place be subjected to the action of an alkaline solution, and then to a solution of chloride of lime.

Gutta percha thus prepared may then be subjected to the cleansing process described in the specification of the patent for England, granted to Richard Archibald Brooman, on the 11th day of March, 1845, for "certain improvements in the preparation and application of artificial fuels, mastics, and cements," or to any similar process, by means of which the gutta percha may be freed from such of its impurities as can only be separated from it by mechanical means.

Secondly, My invention consists of new modes of giving shape and configuration to articles to be made of gutta percha and its compounds, in the manufacturing of such articles, and also of new modes of ornamenting such articles of manufacture. The compounds, of gutta percha most applicable for this purpose are to be produced by mixing gutta percha with caoutchouc and jintawan, or either of them, and thoroughly blending the several materials into one homogeneous mass, in the manner described in the specification of my invention comprised in my patent for England, granted to me on the 12th day of January last, for my invention, therein intituled, "Certain improvements in the manufacture of gutta percha, and its applications alone and in combination with other substances," or by adding to the mixtures or compounds aforesaid, bronze, or other metallic powders, plaster of Paris, or other earthy powders, pigments, fibrous materials cut up short, dust, paper pulp, or any other suitable material. The relative proportions of the materials to be combined being regulated according to the qualities which the compound article is desired to possess.

Gutta percha and its compounds, when in

* For the specification of the preceding patents, see *Mech. Mag.*, Nos. 1180—1181—1182—1183—1185—1200.

a plastic state, may with great facility be moulded into almost any form or shape which the manufacturer may wish it to assume, and this may be done by means of moulds, patterns, shapes, dies, &c., in manner afterwards described. Gutta percha and its compounds, when in a state of solution, may also be applied to moulds, patterns, shapes, &c., so that when several layers thereof have been dried upon such moulds, and then removed therefrom, articles of manufacture may be obtained of the required shape or configuration, as afterwards described.

So also, in forming articles of several sheets, or pieces of gutta percha, or its compounds, the sutures or joints thereof may be softened or made plastic by the application of heat, and joined permanently together by pressure whilst in that state; or such sutures or joints may have gutta percha, or gutta percha compound, in a state of solution applied thereto, as or by way of cement, and the sutures or joints being kept close until the solution has been dried the parts will be permanently united together. Excellent moulds, forms, or shapes, may be made of gutta percha, or its compounds, for the purpose of being used or applied in giving form, shape, or figure, to articles to be made of gutta percha, or its compounds, or of such other substances as can be moulded at a low temperature.

Although several pieces of gutta percha or of its aforesaid compounds have the property, when in a warm and soft or plastic state, of uniting together, and becoming one entire homogeneous mass, yet a piece of gutta percha, or of any of its said compounds, when in a plastic state, will not adhere to any other piece of gutta percha, or any of its said compounds, which is in a cold and rigid, and therefore not in a plastic state.

In order to make a mould, form, or shape of gutta percha, or of any of its compounds, I take a pattern of the article, in the production of which the mould, form, or shape is intended to be used, and apply gutta percha or any of its compounds in a warm and soft or plastic state, and either in sheets or in any other convenient form to the pattern, and manipulate or press the gutta percha or its compound into, upon, or against all the parts of the pattern, so that the intended mould, form, or shape may be capable of producing an article in all respects of the same form, shape, or configuration as the pattern. And when a mould, form, or shape is intended to produce an article having a surface covered with figures or projections, as for instance, the forms of types, wood cuts, printers' blocks, &c., to be used in printing, if the intended mould, form, or shape is to be made by means of gutta percha or any of its compounds in a state of solution, the pattern must have several coats of the solution spread equally all over it, each coat being effectually dried before a succeeding coat of solution is put on, and such a number of coats of solution must be laid on as will produce a solid covering of the desired thickness. Whether a mould, form, or shape of gutta percha, or any of its compounds is made so far by the one or other of the aforesaid modes, it must, if necessary, be strengthened, and that may be done by having a thick coat of gutta percha, or of some of its compounds in a plastic state, or in a state of thick solution, spread all over it (which ought, if necessary, to be repeated), so as firmly to adhere thereto, and make the mould, form, or shape sufficiently firm and strong for the use to which it is to be applied. And if the gutta percha, or any of its compounds, is used in a plastic state for the purpose of strenthening a mould, form, or shape after it has become cold and rigid, a small quantity of it in a state of solution may first be applied to the outside of themould, form, or shape, so as to make the plastic gutta percha, or its compounds, adhere thereto.

A mould, form, or shape, may however be strengthened by any other convenient means. The mould, form, or shape having thus been made according to the pattern, it is, when cold and dry, to be taken off the pattern (either destroying the pattern or otherwise), and, if necessary, parted or cut into several pieces, in the way which is commonly used by persons using moulds for casting.

If, however, it is necessary that a mould, form, or shape should be in several pieces, it will generally be found better to make it in several pieces, by covering only one part of the pattern at a time in manner before described, so as to make only so much of the required mould, form, or shape at one time as shall be intended to be in one piece, and then to allow such piece to become cool and rigid before the next adjoining piece of the mould, form, or shape is made, by which means the several pieces thereof will be prevented from adhering to each other, and each piece of the mould, form, or shape having been completed by covering the pattern in this manner, the whole of the pieces may with ease be detached from the pattern and from each other.

A mould, form, or shape, made as above described, will, if carefully made, possess an accurate impression of the pattern from which it has been taken, and will be found a useful mould, form, or shape for the manufacturing of articles to be made of gutta

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percha or its compounds, or of other materials capable of being moulded at a low temperature. Moulds, forms, or shapes for the manufacturing of articles of gutta percha, or any of its compounds, may, however, also be made of any other fit material, such as metal, glass, wood, or earthenware.

The great advantage of using gutta percha, or any of its compounds, in the making of moulds, forms, or shapes, consists in the cheapness and facility with which such moulds, forms, or shapes may be made from intricate patterns, and the correct impressions which such moulds, forms, and shapes take from the patterns and communicate to articles produced therein. But there is in some cases this disadvantage attending the use of such moulds, forms, or shapes in the manufacture of articles to be made of gutta percha, or any of its compounds, that such moulds, forms, or shapes cannot be heated or kept in a hot state whilst they are being used; for in such a state they would become plastic, and would lose their proper shape, or adhere to the material to be manufactured. It is therefore desirable, whenever a mould, form, or shape, made of metal, or any material that can be heated or kept hot whilst in use, will not be too expensive that the mould, form, or shape should be, formed of such a material.

In using moulds, forms, or shapes made of such a material in the manufacture of articles to be made of gutta percha, or any of its compounds, in a plastic state, as afterwards described, it will be found in some cases that the process will be facilitated by heating the mould, form, or shape to a temperature somewhat less than that of boiling water, and keeping it as nearly as conveniently may be at that temperature, and the plastic material ought also in every case to be kept as nearly as may be of that temperature, until the process is complete, after which the article in the mould, form, or shape, must be put aside to cool, so that the manufactured article may set, or become cold and rigid.

Moulds, forms, or shapes made of gutta percha, or any of its compounds, in manner hereinbefore described, are not only applicable in the manufacture of articles of gutta percha, or any of its compounds, but also in the manufacture of porcelain, earthenware, papier maché, and other articles.

In using moulds of gutta percha, or any of its compounds, black-lead or French chalk may be used as a facing, to secure a perfect delivery from the mould in the ordinary way.

In order to make articles of gutta percha, or any of its compounds, by means of moulds, forms, or shapes, any of the modes I am now about to describe may be adopted.

Thus, if any article is to be made of gutta percha, or any of its compounds, and is intended to be made solid in a close mould, it may be made as follows:—The mould, form, or shape ought to have an ingate, through which the material is to be introduced, and also small outgates, or air-holes, for letting the air out of the mould, form, or shape, in the usual way.

The mould, form, or shape being made sufficiently strong by a jacket or other sufficient means, the gutta percha, or other material of which the article is to be formed, being in a warm and soft or plastic state, and being placed in a cylinder or any other convenient vessel connected with the ingate, is to be forced out of such vessel through the ingate into the mould, form, or shape, by a screw acting against a plunger, or any other convenient means. I have found that it is better that the pressure upon the material should not be withdrawn until the contents of the mould, form, or shape have become cold and firm, or rigid, after which the article may be taken out of the mould, form, or shape, and finished by the removal of accidental excrescences, (if any,) as may be necessary.

Some articles intended to be made solid, may be made in moulds, dies, forms, or shapes which open in two or more parts, by introducing the requisite quantity of plastic gutta percha, or any of its compounds, in one or more pieces, into the interior of or between the parts of the moulds, dies, forms, or shapes, and by then closing, stamping, or pressing the various parts of the moulds, dies, forms, or shapes together, in such a manner as to impress the material with the intended form or pattern. It will generally be found advisable to introduce a very small surplus of material into the mould, die, form, or shape, and by this means the perfection of the form or pattern to be impressed upon the material will be more effectually secured, and the surplus of the material will be pressed out at the joints of the mould, die, form, or shape.

In many cases in which pieces of gutta percha may be introduced or placed into or upon moulds, dies, forms, or shapes of nearly the size and shape which they are intended to assume, such pieces may be impressed with the desired shape and figures, patterns or ornaments, by heating the moulds, dies, forms, or shapes into or upon which they are to be introduced or placed; and after introducing such pieces in a cold state, pressing the same in the moulds, forms, or shapes, so as to produce the required effect.

By adopting this process, the body of a piece of gutta percha will be kept cold, or

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nearly so, and the surface thereof only will be made soft by contact with the heated mould, die, form, or shape, so as to be capable of being pressed or stamped into every part of the mould, die, form, or shape into or upon which it has been placed.

Many of the compounds of gutta percha may be treated in the manner just described; but the smaller the quantity of gutta percha in the compound, the less effective will the operation be.

If a hollow cast is intended to be made, or an article made with a hollow or vacant space in the interior thereof, (in an open mould,) such, for instance, as a bust, the interior of the mould, form, or shape may be covered with gutta percha, or any of its compounds, in a warm and soft or plastic state, the material being carefully pressed by the hand, or any other convenient means, into every part of the mould, form, or shape.

The perfection of the article to be made will be more effectually secured by forcing hot sand, hot water, or hot air into the interior of the article, and by adopting these or any similar means the material may be forced into every part of the mould, shape, or form, and made to assume the form, shape, or figure which is intended.

Hollow articles to be made of gutta percha, or any of its compounds, may also be made as follows:

I take a strong mould, form, or shape, capable of being made air-tight, and made of metal, or any other fit material. This mould must have an ingate and an outgate, each provided with a stop-cock; and the tube of the stop-cock, fitted to the ingate, must proceed a short distance within the mould; and the mould ought to be furnished with strong clamps for clamping it together. The piece of gutta percha, or of any of its compounds, which is intended to be manufactured, must be made into a shape as nearly resembling that of the intended article as conveniently may be, but considerably smaller, and having a space in the interior thereof, or the interior thereof so constructed that the same may, by air blown into the interior thereof, be pressed into every part of the mould, form, or shape. The piece of gutta percha, or of any of its compounds, is then to be connected with the tube of the stop-cock fitted to the ingate, and so that air coming through the ingate may be forced into the interior of the piece of gutta percha, or of any of its compounds, without communicating with the space between such piece and the mould, form, or shape. The stop-cock of the outgate must be fitted so that it may be made to communicate with an air-pump for exhausting the air out of the mould, form, or shape.

A piece of gutta percha, or of any of its compounds in a soft and plastic state, being introduced into the mould in the way already described, and the mould having been strongly clamped together and made air-tight, (the stop-cock of the ingate being closed,) the stop-cock of the outgate is to be opened and made to communicate with an air-pump: the air is then to be exhausted out of the mould, form, or shape by the air-pump; after which the stop-cock of the outgate must be closed, and that of the ingate opened. The pressure of the air proceeding through the ingate into the interior of the piece of gutta percha, or such other material as aforesaid, will in some cases be sufficient to force the material into every part of the mould, and complete the impression which it is intended to receive. But in those cases where such a pressure shall be found to be insufficient, the impression may be made complete by connecting the tube of the ingate with a force pump, and by such a pump (or any other convenient means) forcing hot air or water into the interior of the piece of material to be manufactured, which may thus be effectually impressed with the form or pattern which the mould, form, or shape is capable of impressing upon it.

In case an article is intended to be made in an open mould or shape, with a surface having figures in relief or intaglio thereon, I take the mould or shape, and place in or upon it a sheet or piece of plastic gutta percha, or of any of its compounds, of a size or shape as nearly resembling the shape of the intended article as conveniently may be; I then press a piece of gutta percha, or of its compounds, into, upon, or against the mould or shape by a screw press or any other convenient means of applying pressure, so as to force the soft material into every part of the mould or shape; after which the article must be allowed to remain in the mould or shape and under pressure until cold and rigid.

If it is intended to use a mould in two parts, as an inside and an outside mould or shape for the purpose of producing an article of manufacture, I place the gutta percha, or gutta percha compound, in the hollow or interior of the outside mould or shape, of a size and figure as nearly resembling that of the intended article as conveniently may be, and then I insert the inside mould, shape, or core within the other mould, and within, upon, or against the material placed therein, and press the moulds together by a screw press, or any other convenient means, so as to force the material into every part of the mould or shape; after which, the article must be suffered to remain in the mould or shape, and

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under pressure, until it becomes cool and stiff or rigid. The inside mould or core may when desired be made in several pieces, and gutta percha, or any of its compounds, may be introduced between the several pieces of the core, so as to make divisions or partings in the interior of the article to be produced.

In forming articles of gutta percha by joining sheets or pieces of gutta percha together, I have found that pieces of gutta percha in a cold state cannot be permanently united together in the same way as cold pieces of caoutchouc are usually joined; but if the edges or parts of gutta percha which are intended to be joined together are softened or made plastic by the application of heat, then they may by pressure be effectually and permanently united together. The heat necessary for rendering the edges or parts of gutta percha soft or plastic may be applied by means of a current of hot air, heated iron, or by any other means which may be found most convenient. Care ought, however, to be taken that the parts to be joined are not moistened with water, or greased, because such moisture or any kind of grease will have the effect of preventing the effectual adhesion of the parts.

By adopting this mode of joining the edges of sheets or pieces of gutta percha together in the manufacture of articles, such as are usually made of leather, it becomes unnecessary to sew or stitch such parts together, the parts being more effectually joined by the mode previously described. Pieces of the compounds of gutta percha may also be joined together in a similar manner, with more or less effect, according to the greater or lesser quantity of gutta percha of which the compound has been formed.

I have also found that sheets or pieces of gutta percha, or any of its compounds, may be joined together when in a cold state, by first covering the parts to be joined together with a solvent or solution of the gutta percha, or any of its compounds, as a cement, and then bringing the parts together which are to be joined, and keeping them in that state until they are effectually united, which will be generally effected after two or three hours; but much more quickly if bisulphuret of carbon should happen to be the solvent used.

This mode of joining pieces of gutta percha, or any of its compounds, is not so effective as that before described, but may be useful in some cases in which the other mode cannot with facility be adopted. Either one or the other mode of uniting pieces of gutta percha, or any of its compounds, may be adopted for joining together pieces of any article which may have been separately formed in moulds, forms, or shapes, so as to complete the manufacture of the intended article. Articles may also be made of gutta percha, or any of its compounds, and of some other fit and proper material, for the production of the intended article; thus a metallic chain, or other weight, may be introduced into the interior of any piece or pieces of gutta percha, or of any of its compounds, which is about to be manufactured in any mould or shape. So also, if a wooden or other handle is intended to be introduced into any article, the gutta percha, or any of its compounds, of which the other part or parts of the article is or are intended to be made, may be moulded upon one end, or some other part of the intended handle, by means of a mould, form, or shape, or any other convenient means. And when it is desirable that handles, knobs, screws, hinges, and other furniture and things, should be imbedded in any article made of gutta percha, or any of its compounds, in any mould, form, or shape, such, for example, as doors, framings, panels, or other parts of the bodies of railway or other carriages, and many other articles, such as handles, knobs, screws, hinges, furniture and things, it should have the parts thereof, which are to be so embedded as aforesaid, introduced into the mould, form, or shape, in such a manner that the same shall, during the manufacture of such article, be effectually and firmly embedded in the material of which it is mad

(*To be continued.*)

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 262.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

Jesse Ramsden, of Piccadilly, Westminster, (Middlesex,) optician: for an astronomical æquatorial instrument. Cl. R., 16 Geo. 3, p. 18, No. 14. Dec. 30, 16 Geo. 3; April 27, 1776.

John Arnold, of the Adelphi, Westminster, watchmaker: of an invention of a new pendulum spring for time keepers, and the method of compensating the effect of heat and cold of the same. Cl. R., 16 Geo. 3, p. 18, No. 13. Dec. 30, 16 Geo. 3; April 27, 1776.

John Walker, of Newcastle-upon-Tyne,

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saddler: of a spring saddle and stirrups upon a new construction; [the object being to take off the stubborn resistance usually met with in the common saddles, where they gall the rider, and to prevent a person's foot fastening in the stirrup when thrown from on horseback.] Cl. R., 16 Geo. 3, p. 23, No. 2. June 7, 16 Geo. 3; Oct. 7, 1776.

Henry Marsland, of Bullock Smithy, near Stockport, shopkeeper: of a machine for doubling, throwing, and winding all sorts of yarn made of cotton, wool, or silk, flax, hemp, or mohair, or any other material whatsoever. Cl. R., 16 Geo. 3, p. 25, No. 4. June 6, 16 Geo. 3; Sept. 27, 1776.

Charles Claggett, of Waterford, music master: of improvements in the violin, and other instruments played on finger boards, [which will render it almost impossible to stop or play out of tune, &c.] Cl. R., 17 Geo. 3, p. 3, No. 8. Dec. 7, 17 Geo. 3; April 7, 1777.

Colin Mackenzie, of St. Martin-in-the-Fields, (Middlesex,) whitesmith: of an axis or spindle to be fixed in cranks and pulleys used in bell hanging, and other mechanical operations, upon a new construction. Cl. R., 17 Geo. 3, p. 3, No. 7. Jan. 9, 17 Geo. 3; April 14, 1777.

Solomon Henry, of Swithin's-lane, London, merchant: of a machine for watering roads, gardens, and lands, on principles entirely new. Cl. R., 17 Geo. 3, p. 5, No. 10. Feb. 20, 17 Geo. 3; June 10, 17 Geo. 3, 1777.

John Johnson, of Berner's-street, (Middlesex,) architect: of a cheap and durable composition for covering the fronts and tops and ornamenting of houses and buildings, and for other purposes in the building trade, and which will adhere to surfaces that are wet, as well as those that are dry, at any season of the year. Cl. R., 17 Geo. 3, p. 6, No. 13. March 29, 17 Geo. 3; July 25, 1777, 17 Geo. 3.

Joseph Fisher, of Leicester-fields, Westminster, goldsmith: of a machine called the Universal Machine Lines for writing or drawing. Cl. R., 17 Geo. 3, p. 6, No. 1. June 9 last; Oct. 7, 1777.

William Nicholson, of Bank-buildings, Cornhill, London, broker and lottery-office keeper: of a method for the securing the property of all persons who may become purchasers of shares of tickets in the present and future state lotteries, against the many frauds practised in the selling shares of tickets in the said lotteries. Cl. R., 17 Geo. 3; p. 7, No. 18. July 14, 17 Geo. 3; October 7, 1777.

Robert Barber, of Derby, gent.: of a new machine for making, drawing, sizeing, and proportioning threads of silk, worsted, hemp, flax, gold or silver wire, or other materials; and also for manufacturing, weaving, and making the same into pieces of silk, worsted, or linen cloth, either quite plain or ribbed, figured or flowered, in imitation of tambour or embroidery work. Cl. R., 17 Geo. 3, p. 12, No. 9. May 8, 17 Geo. 3; Sept. 5, 1777, 17 Geo. 3.

(*To be continued.*)

FRENCH TRACING-PAPER.

Sir,—I should feel obliged to your correspondent, "S," if he will mention the name and address of the party in Paris from whom the tracing-paper now so highly approved can be obtained, as some time may elapse before a successful imitation is made in this country.

I am, Sir, yours, &c.,
C. C. C. C.

March 15, 1847.

NOTES AND NOTICES.

Preaching by the Electric Telegraph.—"We have heard of all sorts of communications by means of the electric telegraph, from Queen's Speeches down to doctors' prescriptions, but I have not yet seen it proposed to introduce the agency of this new power into the pulpit. But why not? If, as beautifully observed in the sentiment toasted at a late American festive party, Franklin 'drew the lightning from heaven,' and Morse 'gave it voice, and bade it speak to the world,' why should not that voice be employed to spread Heaven's own 'glad tidings' throughout the world? The pulpits of a whole kingdom might be connected by telegraphic wires, and the exhortations of any celebrated preacher delivered at the same instant throughout the whole breadth and length of the land. It would but require a Reader in each pulpit (in place of Vicar or Curate) to carry this idea into practical effect."—B. H., Clapham, March 14.

Commercial value of the Microscope.—For the best means of detecting the adulteration of musk by the aid of the microscope, we are indebted to Dr. Neligan, lecturer on Materia Medica in the Dublin Medical School. This gentleman states that owing to the high price and great demand for musk, which, as is now generally well known, is the secretion of the *moschus moschiferus*, and is generally imported into the British market from China, in the natural bags of the animal, by the wholesale London druggists, by whom it is retailed to the trade, many of them finding it very much adulterated, prefer purchasing the unopened bag; but that this precaution is not often found a sufficient protection against fraud, as spurious musk bags are very common, and so well prepared by the ingenious Chinaman, that even the most experienced eye is often unable to distinguish the true from the false. It appears that the Chinese, finding a greater demand for musk than they are able to supply with the genuine article, squeeze out some of the secretion, which is fluid in its recent state, and mix it with, it is believed, the dried blood of the animal; this compound, which presents the same physical characters as true musk, they cut into small sacs, made of pieces of the skin cut off from other parts of the animal's body, and prepared with the usual ingenuity of this people, so much so, indeed, as almost to defy detection with the naked eye. The method hitherto adopted for detecting this sophistication has been the peculiar position of the hairs, which are arranged in a circular manner around the genuine musk pod. The

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means which are now proposed to detect the fraud depend upon the microscopic character of the hairs, which grow on the sac of the musk animal, and which differ very materially from those of the false sacs which are met with in commerce. On placing hairs from both under the microscope, it will be seen that those from the natural sac of the animal are furnished in the interior with distinct, regular coloured cells, while in hairs taken from other parts of the animal's body, the cells appear to be obliterated, as is generally the case in this and the allied tribes of animals. The method above proposed is a very simple one and of easy application, now that every pharmaceutist is supposed to be provided with a microscope, without which he could not possibly detect the adulteration of arrow-root, and of the other articles of commerce.—*London Critic.*

Polytechnic Exhibition.—Three years ago there was an exhibition at the "Collegiate Institution" of Liverpool—an institution which does infinite honour to our Lancashire friends—of specimens of "works of art, manufactures, models," &c., which we have heard described as being unparalleled in this country for extent, variety, and interest. The success of that exhibition has induced a determination to have a second in June or July next of the present year, (see our advertising columns,) which may be reasonably expected not to fall short of its predecessor in splendour and utility. Inventors and manufacturers will much consult their own interests by taking advantage of the excellent opportunity thus afforded of giving an extended publicity to the productions of their ingenuity and skill.

Warming with Ice.—In common language, anything is understood to be cooled or warmed, when the temperature thereof is made higher or lower, whatever may have been the temperature when the change was commenced. Thus it is said that melted iron is *cooled* down to a sub-red heat; or mercury is cooled from the freezing point to zero, or far below. By the same rule solid mercury, say at fifty degrees below zero, may, in any climate or temperature of the atmosphere, be immediately warmed and melted by being embedded in a cake of ice.—*Scientific American.*

A Clipper.—The American papers make mention of a model steamboat which is to be seen on the Chesapeake, invented and constructed by Cyrus Williams, Esq., which is in the usual form of a boat, but more flat-bottomed, and much longer in proportion to its width than the boats now in use, giving it a greater surface to the water, and of course a lighter draught. The improvement consists in applying the bridge principle of bearers in supporting the length of the boat. Mr. Williams offers to build a boat on this model, furnishing one-third of the stock, and if it does not make 25 miles to the hour, he will forfeit his share!

The "Sidon" steam-frigate went, on Wednesday last, on an experimental cruise from Portsmouth to test the working of her machinery. The vessel left the harbour about nine o'clock, and proceeded outside the Nab, with a strong head breeze, with 630 tons of coals in her coal boxes, and tanks, water, and provisions for 320 men for three months, complete; all her ammunition, guns, stores, &c., and 25 tons of powder; when she drew 17 ft. 4 in. aft, and 16 ft. 10 in. forward. She went, under the above circumstances, 7½ knots, very steady, and increased her speed up to 8 knots, with her engines making 13½ revolutions and 14. This trial of the capabilities of the *Sidon* was eminently satisfactory, and leaves no doubt that, with her intended increase of compliment of 80 men, she will prove the best steam-vessel for war purposes yet in the Royal navy. Captain Henderson, his officers, and ship's company, have laboured hard to make the vessel in every way efficient, and a credit to the service in which she is destined to figure, and we have no doubt but that the most satisfactory result will emanate from such exertions. The *Sidon* burns only 35 tons of coals per day, full steaming. She can, therefore, steam 23 days right out; whereas the *Terrible* consumes 85½ tons per day, and can only steam at most eight days, being only enabled to carry 550 tons; the *Retribution* about the same, but she is ordered tubular boilers, which will decrease her weight 100 tons, and enable her to carry that quantity more coals. With the expansive gear the *Sidon* made 15 revolutions.

The Phosphorescence of the Sea.—From the topmast the sea appeared, as far as the eye could reach, of a dark red colour, and this in a streak the breadth of which was estimated at six English miles. As we sailed slowly along, we found that the colour changed into brilliant purple, so that even the foam, which is seen at the stern of a ship under sail, was of a rose colour. The sight was very striking, because this purple streak was marked by a very distinct line from the blue waters of the sea, a circumstance which we the more easily observed because our course lay directly through the midst of this streak, which extended from south-east to north-west. The water taken up in a bucket appeared, indeed, quite transparent, but a faint tinge of purple was perceptible when a few drops were placed upon a piece of white china, and moved rapidly backwards and forwards in the sunshine. A moderate magnifying glass showed that these little red dots, which only with great attention could be discerned with the naked eye, consisted of Infusoria, which were of a spherical form, entirely destitute of external organs of motion. We sailed for four hours, at the mean rate of six English miles an hour, through this streak, which was seven miles broad, before we reached the end of it, and its superficies must therefore have been about 168 English square miles. If we add that these animals may have been equally distributed in the upper stratum of water, to the depth of six feet, we must confess that their numbers infinitely surpass the conception of the human understanding. —*Dr. Poppig's Voyage to Chili.*

LIST OF ENGLISH PATENTS GRANTED FROM MARCH 15, TO MARCH 18, 1847.

Sampson Lloyd, of Old Park Iron Works, Wednesbury, Stafford, engineer, for improvements in the manufacture of tires or hoops for wheels and other articles, to be made of iron or steel. March 15; six months.

Charles Fox, of Trafalgar-square, Westminster, engineer, for improvements in the construction of presses. March 15; six months.

Jean Joseph Hazard Petit, of King's-road, Chelsea, chemist, for improvements in the manufacture of oils, and in apparatus for disinfecting and purifying oils and other inflammable or spirituous matters, and improvements in lamps and gas burners. March 16; six months.

Charles Tennant Dunlop, of Glasgow, manufacturer, for improvements in the manufacture of alkali and chlorine, and in application of the products resulting therefrom. March 16; six months.

William Newton, of Chancery-lane, civil engineer, for certain improvements in engines to be worked by gas, vapour, or steam, either separately or in combination. (Being a communication.) March 16; six months.

Joseph Henry Tuck, of Paris, gentleman, for improvements in apparatus for ventilating buildings, carriages, chimneys, and other places, where a change of air is required. March 16; six months.

Robert Scotthorn, of Somers Town, Middlesex, engineer, for improvements in engines for obtaining and applying motive power. March 17; six months.

James Wills Wayte, of Leeds, printer, for certain improvements in self-feeding furnaces, adapted both for land and marine purposes, for the better prevention of smoke arising from fires used in such furnaces. March 18; six months.

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THE Directors intend to open a second Polytechnic Exhibition during the Midsummer Vacation in June and July, and they trust that the same kind feeling which prompted the loan of such a rich collection of Works of Art, Manufactures, Models of Machinery, Specimens of Natural History, Philosophical Apparatus, Curiosities, Antiquities, &c., upon the former occasion, may once more be manifested to the Institution.

Loans of such articles are respectfully requested, and those willing to contribute will enhance the favour by signifying their intentions to the Secretary as soon as possible.

Besides the Exhibition of the articles enumerated, Vocal Concerts, Exhibitions of a Panorama, Dissolving Views, and of the Oxy-Hydrogen Microscope, will be given daily in the Lecture Hall, and every effort made to render the intended Exhibition still more attractive than the previous one, so that it may be equally creditable to the Institution and to the Town in which it will be held.

J. GREGORY JONES, Secretary.

Shaw-street, March, 1847.

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It is remarkable that, whilst great improvements have year after year been made in locomotive engines, the construction of the road upon which those engines are to run has remained without any improvement since the time when the Liverpool and Manchester Railway was made.

The great improvements which have been introduced into locomotive engines have now, however, rendered it absolutely necessary for engineers to turn their attention to the best means of improving the construction of what is called the permanent way of railways.

With a view to such object this Company has been projected, for the purpose of introducing a new kind of railway sleeper, which has been patented, and which embraces many advantages, besides those of economy and unlimited durability. They have been tested on the London and North-Western (London and Birmingham) for the last ten months, and for which line a further quantity are in course of manufacture.

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March 4, 1847.

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MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

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E. GRANVILLE, Manager.

London, March 3, 1847.

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CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W.C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1233.] SATURDAY, MARCH 27. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

THOMSON'S PATENT AERIAL WHEELS.

Fig. 1.

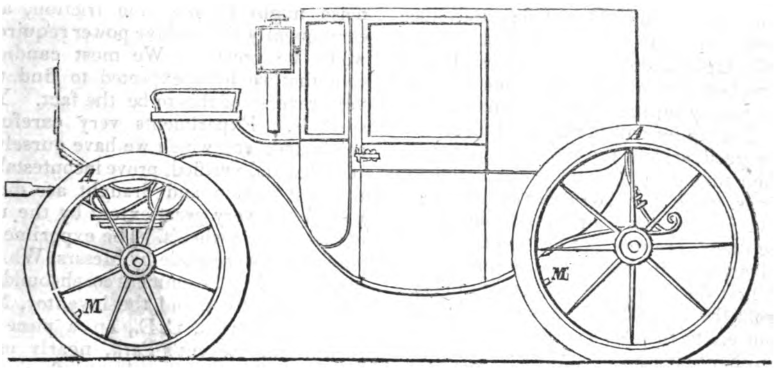


Fig. 2.

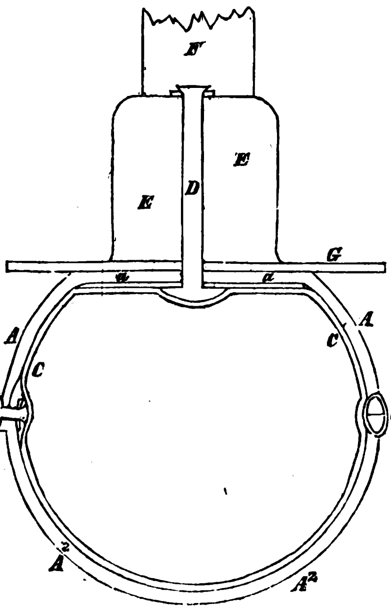


Fig. 3.

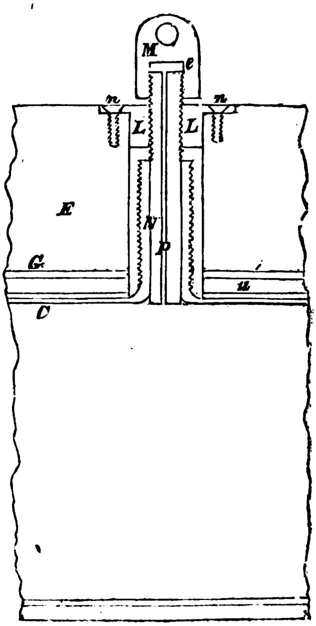
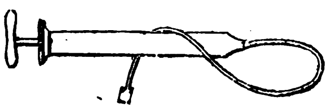


Fig. 4.



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THOMSON'S PATENT AERIAL WHEELS.

We gave a slight notice of these wheels at the time of the first appearance in public of a carriage fitted with them, about six months ago, (see *Mech. Mag.* No. 1202, Aug. 22, 1846;) and since then, we have been favoured with a full explanation of their mode of construction, and also had an opportunity of personally testing their capabilities.

The reader will perhaps recollect that the peculiarity of these wheels consists in their tires being formed of elastic tubular rings, made of india-rubber (vulcanized), and inflated with air to any degree of tightness desired. The most obvious advantage—indeed, the only one which, at first sight, would seem likely to result from the substitution of an elastic for a non-elastic tire—is a diminution of noise; and hence it was, that we were led in our former notice of these wheels to characterize them as "silent," rather than as being distinguished for any other property. It has been so long regarded as a settled thing, that friction is least with hard substances, and greatest with soft, that, by a natural, though not perhaps strictly logical, course of induction, we inferred that, though in this case the noise might be less, the friction, and consequently the tractive power required, would be greater. We must candidly own that we little expected to find the very reverse of this to be the fact. Yet so it is. Experiments very carefully conducted, and which we have ourselves repeated and verified, prove incontestably that the friction and draught are diminished to a very great extent by the use of these elastic wheels. The experiments we refer to were made by Messrs. Whitehurst and Co., the eminent coach-builders of Oxford-street, and the inventor, Mr. R. W. Thomson, C. E., on a piece of road in the Regent's Park, nearly one-half of which is smooth and firm, and the other covered with newly-broken stone. The results are shown in the following table:

Result of Experiments tried by Messrs. Whitehurst and Co., and the Patentee, for ascertaining the comparative Draught of R. W. Thomson's Patent Aerial Wheels and the common Wheels. Tried in Regent's Park, March 17, 1847.

Weight of Carriage, 10½ cwts.	Common Wheels. Actual draught in pounds.	Patent Wheels. Actual draught in pounds.	Saving of draught by Patent Wheels,
Over a smooth, hard, macadamized level road	45	28	60 per cent.
Over new broken flints................	120	38½	310 per cent.

We made ourselves a similar set of experiments on Tuesday last with the same vehicles as employed by Messrs. Whitehurst and Co., and Mr. Thomson, and over the same piece of ground, and the results we obtained, differed but little from theirs. On the smooth part the average difference with us, was as 28 to 43½ (instead of 28 to 45), and on the rough ground as 35 to 115 (instead of 38½ to 120.) The greater disparity in the latter case, was no doubt owing to the rough part of the ground having become more consolidated, during the few days which intervened between the two sets of experiments.

The instrument employed by both parties to measure the tractive force was a common spring dynamometer, which, as all our scientific readers know, is much inferior to the oil and piston apparatus of M'Neill, and can at best give but results of approximative accuracy. Any allowance, however, which can be asked for on this score, would tell as much against the common as against the patent wheels, and could not, in any view of the matter, affect such large differences as 60 and 310 per cent.

It stands thus established, that we have here a wheel which not only makes little noise, or, more strictly speaking, perhaps, which is in itself noiseless, for to us it seemed, as if all the noise were occasioned by the rumbling of the body of the carriage, and parts in connection with it—but which requires from one to three times less tractive power than a common carriage; and which must consequently be much less subject to wear, and last proportionately longer.

The wheel-tires of the carriage with

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which we made our experiments were stated to have travelled upwards of 1200 miles on all sorts of roads; yet we could not discern in them the slightest symptoms of deterioration or decay.

Fig. 1 is a general view of a Brougham carriage, fitted with these aerial wheels, (without springs,) on a scale of 1 inch to 3 feet.

Fig. 2 is a cross section of the felloe, tire, and elastic tube, on a scale of 6 inches to 1 foot, or half the actual size.

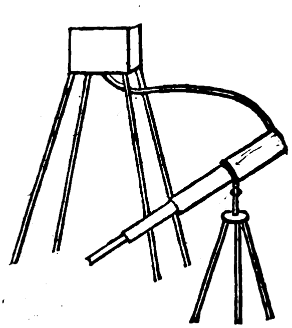
Fig. 3 is a vertical section of part of the felloe and tube in the plane of the spokes.

Fig. 4 is a view of the condenser used for filling the tubes with air.

F is part of the spoke of the wheel; E, the felloe; C, the tire, which is made about 4 inches broad, but only one-eighth of an inch thick. A strip of leather, AA, is placed round the wheel, and the hoop, *aa*, is placed tightly over it, and secured to the felloe by the screws or bolts, D. The india-rubber tube, CC, is then placed round the wheel, and the strip of leather, A^2A^2, is riveted on the outside, as shown at *b*, and, being brought over the india-rubber, is laced at *c*.

The means of inflating the tube are shown in fig. 3. The nipple, N, is formed on the india-rubber tube, and the pipe P is securely tied into it. The pipe P passes through the felloe, and is secured in its place by the collar, L, which is let into the felloe, and secured to it by the screws *nn*. M is a brass cap which screws on the end of the pipe P, and presses down the leather washer, *e*, on the minute orifice in the pipe.

IMPROVED PHOTOMETER.



Sir,—I respectfully submit to your attention the following plan for constructing photometers to act independent of heat, and which affords a means of comparing the intensities of all kinds of light.

I would first suppose a water-tight telescopic tube constructed with a piece of plain glass at each end. Let the object-glass have a metallic cap fitted to it, so as to leave only a small spot clear in the centre. Let the tube be filled with a dark coloured fluid, flowing from an elevated reservoir through a flexible pipe fixed into the telescopic tube near the object-glass; this plan will allow the tube to remain full of the fluid while it is being lengthened. In order to observe the intensity of the sun's light, let the tube be directed towards the sun, so as for a beam of light to run along the axis of the tube. Let the observer look through the eye-piece, and lengthen or shorten the tube till he gets it to the extreme length at which he can perceive the transmitted sun-beam. Then let the length of the tube be measured by any suitable contrivance. In like manner any other luminous objects may be viewed, the length of the tube in each instance showing the intensity of the light. But the same medium would not suit all objects, and this opens a new question. Perhaps two media would be sufficient, as the medium suitable for the moon and stars would probably suit terrestrial flames.

Let us suppose the coloured fluid for observing the sun to be made of so many pounds of water and so many of indigo (or anything else suitable.) Let us suppose another tube made, and filled with a clearer medium of water and indigo. Now, in this case it is necessary to know how far the sun's light would penetrate the second medium when it penetrates the first to a certain given distance. This, probably, could not be found by *direct* experiment, owing to the great length that would be required in the weak medium; I therefore suggest the following method:

Suppose the medium for observing the sun to consist of 10 lbs. water and 1 lb. indigo, let the quantity of water remain the same, but let the quantity of indigo be augmented by the continual addition of equal quantities, and at each addition let the length of the solar ray be observed. Surely, by this method the ratio of the length of the ray to the density

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of the medium might be discovered, so that by knowing how far the sun's light would penetrate 10 lbs. of water and 1 lb. of indigo, we should be able to calculate how far the same ray would penetrate any other mixture of indigo and water; and finding how far a lunar or stellar ray would penetrate this other mixture, we should be able to compare the lunar or stellar ray with the solar.

I have not said anything about the effect of distance, as that is well known. In observing terrestrial flames with this photometer, it would be necessary to employ a lens to make the divergent rays fall parallel upon the object-glass.

Much more might be said, but I have already occupied too much room, and must therefore conclude, subscribing myself,

Yours respectfully,
JOSEPH PITTER.

7, George-street, Hastings,
March 17, 1847.

CHAPTERS ON ANALYTICAL GEOMETRY. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from page 272.)

CHAP. IV.—*On the Hyperbolic Paraboloid.*

SECTION 1.—*Auxiliary Quantities.* In these investigations the introduction of three auxiliary quantities u, v, and w, will be found useful. The significations attached to them will be seen from the following equations:

$$u = \text{A}x + ay + \beta z + \gamma,$$
$$v = \delta y + \varepsilon z + \zeta,$$
$$w = \eta z + \theta.$$

SECTION 2.—*Intersections.* Let the hyperbolic paraboloid, represented by the equation

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} - 2lz = 0,$$

have rectilinear intersection with the plane represented by

$$px + qy + rz + s = 0,$$

then the following condition must be satisfied,

$$2rs - l(a^2p^2 - b^2q^2) = 0.$$

The equations of the rectilinear intersections will be, taking the signs in their proper order and as usual,

$$(bx \pm ay)r + l(ap \mp bq) = 0, \text{ and}$$
$$(a^2p^2 - b^2q^2)x + a(ap \pm bq)(rz + s) = 0.$$

SECTION 3.—*General Case.* When the quantity $a^2p^2 - b^2q^2$ is different from zero, these equations represent *intersecting* straight lines. And since for the same values of p, q, and r, there can only be one value of s, we see that, *if the hyperbolic paraboloid have such a double rectilinear intersection with a plane, it can have no such intersection with any other plane parallel to that plane.**

The above proposition is also true of the *cone*, but not of any other surface of the second degree. The hyperbolic paraboloid will however be distinguished from the cone by the fact that, in the former case, the position of the plane will be given by a linear equation, in the latter by a quadratic with *equal* roots.

SECTION 4.—*A Special Case.* When $a^2p^2 - b^2q^2$ vanishes, the last two formulæ cease to be applicable. Our equation of condition requires that either r or s should vanish. We must take $r=0$, for if we suppose $s=0$ we shall not obtain rectilinear intersection with the plane. The equations of the intersection will, in this critical case, be

$$2psx + 2lb^2q^2z + s^2 = 0, \text{ and}$$
$$2qsy - 2la^2p^2z + s^2 = 0;$$

it consequently consists of a single straight line. And in order that the intersection may consist of a single straight line, r and (consequently) $a^2p^2 - b^2q^2$ must vanish. Since s is perfectly undetermined, we see that *if a plane meet the hyperbolic paraboloid in a single straight line, an indefinite number of planes may be drawn, parallel to that plane, each of which will meet the hyperbolic paraboloid in a single straight line.*

SECTION 5.—*General Propositions.* From the preceding remarks and formulæ we have no difficulty in seeing that

The hyperbolic paraboloid has either (1) *a double rectilinear intersection with* one, *or* (2) *a single rectilinear intersection with* an indefinite number of, *planes parallel to a co-ordinate plane; the single intersections not being parallel to another.*†

* See Leroy, *Analyse appliquée à la Géométrie des Trois Dimensions* (Paris, 1835,) p. 105, No. 163, and pp. 110, 111, No. 171, and compare the results there given with some of the above.—J. C.

† If, however, in the equation of the problem at p. 248 of this volume, we make $x = \infty$ and $x = -\infty$ successively, we obtain two parallel lines; or rather two lines inclined at an infinitely small angle. (*Ante*, p. 245.)—J. C.

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The double intersection never consists of parallel straight lines. When the cutting plane is parallel to that which forms the plane of xy in Section 1, we shall have no rectilinear intersections parallel to it—they are all hyperbolas. By the term "a co-ordinate plane" may be understood "some, two at least, of the co-ordinate planes." The above propositions and the corresponding ones in the preceding *Chapters* are true for any system of co-ordinate planes. It was only for convenience that I chose the particular forms of the equations of the hyperboloid of one sheet and the hyperbolic paraboloid made use of in this and the preceding chapter, for the purpose of determining their rectilinear intersections with planes.

In seeking the converse of the last proposition, we find the following.*

If a surface of the second degree have a single rectilinear intersection with an indefinite number of planes parallel to a co-ordinate plane, such intersections not being in general parallel, the surface is the hyperbolic paraboloid.

When the intersections are parallel the surface is the single plane. Again,

If a surface of the second degree, being met in intersecting straight lines by a plane parallel to a co-ordinate plane, cannot be so met by any other plane parallel to that plane, the surface is either the hyperbolic paraboloid or the cone.

I have already (in Section 3) pointed out how the former may be distinguished from the latter surface.

SECTION 6.—*Examples.* It now remains to apply these propositions. One application will be found at p. 248 of this volume. I give two others. In one of them an omission made at the page just mentioned is supplied.

Ex. (γ.) What is the surface represented by the equation

$$kyz + a(h-k)xz = hky\,?$$

(Leroy, p. 117, No. 179.)

This may be put under the form

$$a(h-k)z.x + (kz - hk).y = 0;$$

and there are an indefinite number of planes parallel to that of xy, which have a single rectilinear intersection with the surface; and since z has a different value for each plane, the single intersections are not parallel. Hence the surface is the *hyperbolic paraboloid.*

Ex. (δ.) Determine the surface whose equation is

$$x^2 - 2y^2 - 3yz + 3zx + xy + 4z = 0.$$

(Leroy, p. 163, No. 248.)

For the actual process see my paper at pp. 257, 258, of vol. II. of the *Mathematician.* The following is an abbreviated method, which may be used in practice. Arrange the example and proceed as below†;

x^2	yx	y^2	zx	zy	z^2	
1	1	-2	3	-3	.	4
.	.	.	.	.	.	.
		-8		-12		16
		-1		-6	-9	
—	—	—	—	—	—	—
	u^2	-9		-18	-9	16
		.	.	.	.	.
		-3^2		-6.3	-9	16
					$+9$	
		—	—	—	—	—
	u^2	—	v^2			$+16z$

This last is the form to which the given equation can be reduced, the values of u and v being respectively as follows:

$$u = 2x + y + 3z$$
$$v = 3y + 3z.$$

Making $z = 0$, we see that the surface cuts the plane of xy in two intersecting straight lines, and no other plane parallel to that of xy can have such an intersection with the surface. Further, this plane of xy is determined by means of the *linear* equation $16z = 0$, and not by a quadratic of the form $(az)^2 = 0$. Hence the surface is the *hyperbolic paraboloid.*

(*To be continued.*)

COAL-PIT EXPLOSIONS.

Sir,—Allow me, I pray you, through the medium of the *Mech. Mag*, to offer for the consideration of those who are

* I purpose an extension of these methods to surfaces of the higher degrees, and merely allude thus casually to the fact, that I at present contemplate a *Theory of Surfaces of the Third Degree,* because anything like a discussion of such Theory in this work would be misplaced.—J. C.

† The second line of figures is obtained by multiplying into 4 the terms free from x. This is done to avoid fractional quantities. The third line is the square of half the coefficient of $2x$, with the sign changed. The *figures* in the fourth line are the sums of those in the second and third. The figures in the fifth line are those on the fourth put under a different form, advantage being taken of the fact that 9 is a square. The rest of the process will be clear on considering the original discussion (*Mathematician*, vol. II., pp. 257—8.) The praxis may probably be further simplified.—J. C.

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interested in mines, some suggestions with a view to the prevention of these dreadful explosions, or, at any rate, to a mitigation of their evil consequences.

A thorough ventilation of the mine, no doubt, is the best method of obviating these explosions; but then there is the difficulty of effecting such a ventilation, which, to say the least of it, is great. If, therefore, some plan could be devised whereby the foul air could be ignited and exploded when the people are out of the pit, such a mode of dealing with it, though attended with some mischievous consequences, would be preferable to allowing the explosions to occur as they do now, bringing with them ruin, and death, and endless misery. And this end, I think, may be attained by a judicious application of the galvanic battery. The wires from the battery might be carried down the shaft to the works, and, from those wires, other wires might be carried along the roof, or sides of the drifts or breaks, connected at intervals of a few yards with a piece of fine steel wire, all of which connecting wires would be ignited when the connection with the battery took place, to such a degree as would, I think, ignite the foul air; but if the fire of the connecting wires should be insufficient to ignite the foul air, small quantities of explosive substances might be attached to them, the ignition of which would effect the purpose.

By such an apparatus, all the drifts or breaks in the pit might be operated on at once; or, by detaching the wires which run along the drifts or breaks from the wires which descend the shaft, part only of the drifts, or any one of them in particular, might be operated on and tried. Since the place and position occupied by the foul air can be exactly ascertained, surely it may be dealt with and made less mischievous by these or some such means; and I apprehend that a coal mine might be fitted with an apparatus, like the one above mentioned, at the expense of a few pounds.

And I have also a plan for ventilating mines, which I wish to submit for consideration; namely, if a pipe, or tube, of sheet-iron, or tin, a foot or 18 inches in diameter, were let into the side of the shaft and carried down to the works, and then carried round the shaft, and from this circle pipes or tubes of smaller diameter were carried along the roof of the drifts or breaks, having proper holes, or openings, in them, at which the vitiated air might enter; through this apparatus, I apprehend, the foul air would rise and cause a current, which would ventilate the mine; especially if the pipe or tube which descends the shaft were also carried up 8 or 10 yards higher than the mouth of the pit. And if the apparatus itself did not bring about a current and ventilate the mine, it would be easy to connect the tube or pipe, at the top of the shaft, with an exhausting air-pump, to be worked continually, or occasionally, as might be found necessary; and that, I am persuaded, would effectually ventilate the mine at, all things considered, a moderate cost.

I am, Sir, yours, &c.

G.

THE PADDLE AND SCREW.

Sir,—I am gratified by finding "Justice" willing to give the *screw* its due, and should have left it to his care to show your readers all the advantages and drawbacks, without my troubling you any further upon the subject, if I had not observed one or two matters mentioned that I think require a passing remark.

First. "Justice" speaks of "screw vessels being famous for rolling." This may probably be the fault of the VESSEL being built without a proper consideration of her not having paddle boxes, as no doubt they must tend very much to bring her to an even beam, when rolling, by *cutting short her lea lurch* when the lea-paddle box comes to the water; but I doubt if this is so well for the vessel, as if she were allowed to take her fair roll without any such sudden check. Besides, supposing screw vessels to have this fault, it could be very easily remedied.

Second. "Suppose the vessel on her broadside." He makes it quite clear that the screw would be useless, but surely this does not apply to the screw alone. Would the paddle be in a better plight, with one of them wholly in, and the other wholly out of the water?

Third. "It is a very different thing using a screw in a fluid, to what it is using it in a solid." Again, may I ask, does not the same remark apply to the lever (or paddle)?

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Fourth. Supposing the screw to be rendered useless, "the opening in the dead wood may be considered to affect the steerage; for, as the ship's stern swings round, from the obliquity of the rudder, the water must pass through the opening, and thus, to a certain extent, neutralize the effect of the rudder." It appears to me, the effect would be the reverse of this, for the rudder (with the tiller) is merely a lever to move the ship round her centre of motion; and supposing the helm to be put hard a starboard, the dead wood would of course be moved nearly broadside on through the water to starboard; and if part of the dead wood is removed, there must be less resistance; and I will grant that this may cause the vessel to steer more *wild* than she otherwise would when running large, and a heavy sea on.

Fifth. I think, that in the last sentence of *his* second advantage, your printer has omitted the word "*not*," by mistake.

Sixth. "Justice," in his remarks respecting my suggesting a screw of larger circumference, states that the dead wood will not admit of it. Is there any absolute necessity for the screw being placed in the dead wood? Why not allow it to work *just* abaft the rudder? In a description of the *Princeton*, American steam frigate, given in your Magazine some time since, her screw is stated to work thus, the shaft entering on one side of the stern post, and a notch cut in the rudder abreast of it, to allow the rudder to work. No doubt, even then, the screw could not be of the circumference of the present paddle wheel, but I think it could be much larger than when placed in the dead wood.

There is much in your correspondent's concluding remarks which I confess I do not understand, but his observation respecting his anonymous signature I think very just, where no *personal* attacks are made; the information given must be equally valuable, and as a proof of my so thinking, I still sign myself, your old subscriber,

T. W.

Esher, Surrey.

THE GUTTA PERCHA PATENTS.—NO. VII. MR. CHARLES HANCOCK'S—CONCLUDED FROM P. 284.

When a piece of wood or other material is intended to be introduced into an article, to be partly formed of gutta percha or any of its compounds, in a shape which would easily draw out of that part of the article which is formed of the gutta percha, or any of its compounds, that part of the material which is intended to be introduced into the gutta percha, or its compounds, should be made with projections upon it, or holes in or through it, so that it may be securely and firmly held by the gutta percha or its compounds.

Articles may also be made of gutta percha, or any of its compounds, formed upon skeleton or other shapes, forms, or foundations made of iron, wood, or any other fit material, such as saddle-trees, skeleton forms, axles, or shafts of rollers, &c.

The skeleton form or shape of a saddle-tree may be made of perforated iron or other metal, and the plastic gutta percha, or any of its compounds, may be moulded upon it into the shape of the intended saddle-tree, care being taken that the plastic material is pressed through the perforations of the skeleton form or shape, so as to unite and bind together the material which is upon each side of the skeleton form or shape. The same mode of manufacturing may be adopted in the production of numerous other articles; and in making some of them, a skeleton form or shape of iron or other metal, wire gauze or cloth, or any perforated pieces of metal or other suitable substances, may be used. Thus, also, skeleton or other forms, shapes, or foundations for hats, bonnets, or linings, may be covered with gutta percha, or any of its compounds, in manner aforesaid, and so made into a hat, bonnet, or lining.

Skeleton forms, shapes, or foundations may also be covered or saturated with gutta percha, or any of its compounds, by saturating or coating such forms, shapes, or foundations with the gutta percha, or compound of gutta percha, in a state of solution, and when dry repeating the process, if desired.

A roller may be made with a surface of gutta percha, or any of its compounds, by taking a roller of iron, wood, or other material, turned somewhat less in diameter than the intended roller, according to the intended thickness of the gutta percha or its compounds. Upon this roller of iron, wood, or other material (leaving small orifices or holes in the surface of it, into which parts of the soft material may be pressed to keep the whole firmly in its place,) must be placed a sheet of plastic gutta percha, or any of its compounds, (according to the quality which the material of the surface is required to possess,) so as to surround and cover the roller equally in every part, and the edges of

the sheet must be pressed together whilst soft, so as to adhere together in manner before described. And gutta percha, or any of its compounds, may be put upon the surface of a roller in a mould, form, or shape, such as before described.

Thirdly, I employ for ordinary letterpress printing, sheets made of gutta percha alone, or together, with any other material or materials, and prepared in the manner described in the specification of the letters patent for England, granted to Richard Archibald Brooman on the 11th day of March, 1845, preferring to have the gutta percha of a light colour, or made of a light colour, by mixing with it while passing through the kneading-machine (in the manner also explained in the said specification) some flake white, chalk, or other white or light colouring ingredient, reduced to a fine powder. Sheets of gutta percha, or of any of its compounds, thus prepared, may be passed through the printing press in the usual way, but without inking the form of types as usual. By the mere pressure of the dry surface of the type against the dry surface of a sheet of gutta percha, or its compound, in the press, distinct and legible impressions of the types will be produced on the sheet.

I also employ sheets, prepared as last aforesaid, in printing, by means of engraved or otherwise figured copper or steel plates or cylinders, and the presses usually made use of for working the same, and by printing upon such sheets without inking the engraved or hollow parts of the plates or cylinders. Plates or cylinders being pressed upon or against sheets by presses in the ordinary way, distinct impressions of the engravings, or other figures, upon such plates or cylinders will be obtained.

I also impress on such sheets as last aforesaid, all such letters, figures, images, and marks, as are now commonly produced on surfaces by means of engraved blocks or rollers, or dies or stamps, or punches or types, whether the same are engraved or cast in relievo or intaglio, or cut through and through, and this also by bringing such blocks, or rollers, or dies, or stamps, or punches, or types, into dry contact as aforesaid with such sheets, and under more or less pressure, employing for the purpose of such pressure any of the well-known means of printing, pressing, striking, stamping, or punching now in common use. And in this case I vary the thickness of the sheet subjected to the operation of the said blocks, rollers, dies, stamps, or punches, or types, according to the degree of high or low relief, or intaglio, intended to be produced.

Sheets of gutta percha, punched or cut through and through according to any pattern which may be required, may be fastened or cemented upon other sheets, or upon blocks of gutta percha, by means of heat, or by solution, in manner hereinbefore described, so as to form either sunk or raised figures of the required patterns or designs, upon the sheets or blocks upon which the perforated sheets may be fastened or cemented, and the different sheets or blocks may be made of various colours, so as to make raised figures or patterns of different colours from the blocks or sheets upon which they are to be fastened or cemented, and to produce various other effects.

In order to produce impressions of a still more distinctive and striking character than are to be obtained by any of the preceding processes, I prepare the sheet or piece of gutta percha in such manner that the raised or sunken parts shall be of a different colour from the rest, or, as it is technically called, "the ground." In this case, I spread the gutta percha by any of the modes described in the said specification of the said Richard Archibald Brooman before referred to, on a surface of cloth paper or other suitable material, of a colour as opposite as may be to that of the gutta percha. For example, the ground may be black, and the gutta percha white, or *vice versâ*; I then pass a sheet or piece of the gutta percha, so prepared or combined, with its gutta percha surface uppermost, through an ordinary printing-press, as aforesaid; or I subject it to the pressure of a figured block, or roller, or die, or stamp, or punch, or type, also as aforesaid, whereby an impression is produced thereon, in which the figurated or distinctive parts are of the colour of the ground, and the rest of the colour of the gutta percha.

I also make use of gutta percha prepared and combined as last described, and cut into sheets or pieces of any convenient size, as a material for writing and drawing upon, without the aid of either ink or of any other colouring medium. I employ for this purpose a dry style, of ivory, glass, or some other material which will not leave by the mere effect of contact a visible stain, and write or draw therewith by hand on the sheet or piece of gutta percha surface, in the same way as on common paper, with pen and ink, or lead-pencil, or crayon.

Fourthly. I prepare a material of gutta percha, or gutta percha compound, with a polished glossy surface, like japanned leather. For this purpose, I first give a sheet of gutta percha, or of gutta percha compound, a coat of thin solution of gutta percha, or of gutta percha compound, or a

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coat of turpentine, for the purpose of making the surface of the sheet more readily receive and retain the varnish which is intended to be put upon it.

The sheet thus prepared, I varnish over either with japan varnish, or varnish such as used in making japanned leather, or with varnish such as described in my said specification before referred to.

A sheet of gutta percha, or of gutta percha compound, in being thus prepared, will generally require one or two coats of varnish.

Fifthly. I inlay and veneer sheets of gutta percha, or of gutta percha compound, or make tesselated or figured surfaces thereon, and also unite sheets or pieces of gutta percha, or any of its compounds, with other substances, in the following manner:

Upon a flat surface I lay down pieces of gutta percha, or of any of its compounds, coloured or not coloured, as may be desired, and in the intended forms which are to be pressed into or united to a sheet of gutta percha, or any of its compounds, so as to make a veneered surface of the whole of such sheet, or to inlay a portion or portions of the surface of such sheet. The pieces of gutta percha, or of any of its compounds, to be united or pressed into the surface of a sheet, may be made thin, like veneers, and must be placed in the desired positions upon the flat surface upon which they are laid, previously to having the sheet pressed upon them. The pieces being thus laid in order upon a flat surface, a sheet of gutta percha, or of any of its compounds, in a warm and soft or plastic state, is then to be placed on the pieces as they are lying upon the flat surface, against which they must be pressed, so as to make the figured pieces of the remainder of the sheet (if any), not covered therewith, all of an even and flat surface. The surfaces which are intended to come in contact with each other, and to unite in this way, will be more effectually united by previously giving one of them a thin coat of a similar material in solution, or a coat of turpentine, or some other solvent.

Pieces of thin metal, wood, and other materials, of any desired form, may also be united to or pressed upon or into the surface of a sheet or piece of gutta percha, or of any of its compounds, so as to make a veneered, tesselated, or inlaid surface, as before described. But such pieces of metal, wood, and other materials, should have the surfaces roughened which are to be brought into contact with the gutta percha, or gutta percha compound, and had better be first coated with a solution of gutta percha, or some of its compounds, on the surface which is to be placed next the sheet or piece of gutta percha, or of gutta percha compound.

I also cover pieces of wood, metal, papier-maché, pasteboard, and other solid substances, with veneers, or thin sheets of gutta percha, or any of its compounds, in a plain or figured state, and either coloured or not coloured; and when coloured, either of one or a variety of colours;—the adhesion of the sheets being caused by means of a coat of solution, applied in manner aforesaid.

Sixthly. I make paper and pasteboard in the following manner:—I take paper pulp, or paper dust in a dry state, and intimately mix and amalgamate with it a sufficient quantity of gutta percha to reduce the mass to a plastic and tenacious state. I then pass it between polished rollers, or press it between plates into sheets of any required thickness.

The paper may be coloured by adding any suitable pigment, in a state of fine powder, during the amalgamation of the materials.

I also saturate or coat paper with a solution of gutta percha, by immersing it in a solution of that article, or by giving it a coat or coats of such solution, after which it must be dried, and, if desired, pressed or rolled in the ordinary way.

Paper may also be prepared by dusting it all over with fine dust of gutta percha, and then passing it between warm rollers to be pressed.

I prefer using paper to be prepared as above described in the unsized state; but sized paper may be used, if desired. Pasteboard may be formed by cementing two or more sheets of the gutta paper together, or by cementing sheets of plain paper to sheets of gutta percha paper.

I also incorporate the gutta percha with the paper pulp in the moist state, as in the ordinary course of manufacture. To effect this purpose, I mix the gutta percha with the pulp, in a very finely-granulated state, by agitation with the paper pulp whilst in the vat, which should be kept at about 150° Fahrenheit; or I use a solution of gutta percha.

The paper when dry may, if desired, be passed between rollers, cold, or slightly warm.

Seventhly. I prepare a solution of gutta percha, or of a combination of gutta percha, with caoutchouc and jintawan, or either of them, by dissolving the same in bisulphuret of carbon.

This solution must be prepared in the same manner as a solution of caoutchouc, the proportion of the solid material to the solvent being varied according to the purpose for which the solution is required; and as the solution may be required to be thicker

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or thinner. These solutions, especially that of gutta percha alone, will be found to be valuable for many of the purposes to which solvents are hereinbefore directed to be applied; and they will also be found to be particularly useful for cementing and for coating of various articles of manufacture, and for the making of waterproof cloth.

MATHEMATICAL NOMENCLATURE—CAMBRIDGE TREATISES.

Sir,—Several weeks since, some of your correspondents complained of the ambiguity attending the use of the symbol (π) in trigonometrical formulæ. Not having experienced this difficulty myself, (perhaps from want of practical application of the formulæ,) I have waited anxiously for further information; in the absence of which, perhaps, the following remarks (should they be worth inserting) may lead Mr. De Morgan, or some other of your able correspondents, to throw further light on the question.

I have always considered that (π), as the circular measure of two right angles, was a constant quantity, and might, therefore, be represented at any time by its numerical value. If we once admit the all important point, that a ratio is expressed by a fraction, which may be cut and shuffled through algebraical processes just as any other fraction, then I think it must always for arithmetical purposes, as an ingredient in an equation, represent a number. In no other character can it be a factor, or an item of any description in a sum. I cannot, therefore, understand the complaint, that π "sometimes denotes the circular measure of two right angles—at other times, a mere number." For all that I can see at present, we might just as well complain that £5, in a common rule-of-three sum, sometimes denotes five golden sovereigns, at other times a mere number. *All* quantities must enter a sum as mere numbers;—in no other light can they possibly be summed. It is thus that in the rule-of-three (which otherwise is stated unmathematically at the very outset) every variety of commodities, and pecuniary units of every description, are worked together as mere numbers, just because, *pro hâc vice*, they are so. They enter the sum in the sole character of bearing an arithmetical relation to their respective units, which is all we know of them, *quoad computation*.

Nor does the equation adduced by your correspondents, (viz. $\sin\theta = \theta - \frac{\theta^3}{\angle 3}$), at all help me to a comprehension of their difficulty. They complain (p. 236, and again at p. 365) that "θ on one side of the equation denotes the number of units of circular measure, and on the other a mere number." But *when* is θ on the first side of the equation? Sin θ is not θ, nor any "multiple part or parts" of it. Neither the sinal, nor any other of the so-called goniometric lines, can possibly represent an angle, for the simple reason that they do not vary with it. I have myself always understood that equation, to be one between the sine and circular measure of an angle—that is, when radius is the same between the sinal line and its arc—the principle on which tables are calculated.

The remedy for this alleged difficulty suggested in p. 164, that the factor 57, &c., or its symbol, should always be annexed, assumes that one degree is a more natural angular unit than 57, &c., whereas it is, to say the least, quite as arbitrary. Even otherwise, there appears no more necessity for the proposed amendment than for always stating the value of a guinea in shillings whenever it appears in a sum. Moreover, a degree, unless radius be given, is an abstract idea. In order to give it a "local habitation" among the straight goniometric lines, we are obliged to connect it by comparison with the radius, in which shape it becomes a constant quantity for the same angle, and also varies with it, and "may thus be said to be equal to it"—(*Snowball's Trigonometry*, p. 59;) that is, I suppose, may be taken as its arithmetical representative—for in no other sense are they comparable.

If, then, a fraction $\left(\frac{\text{arc}}{\text{radius}}\right)$ be the fittest algebraical expression for an angle, how can we avoid making that angle the unit for which the numerator and denominator are equal? It appears to me a case of necessity.

Hoping that I have not spoken too positively, for which, if it be so, I desire to apologise, (as also if I have misapprehended them, which I think I must have done,) I am, Sir, yours, &c.

W. M.

P.S. Since writing the above I have

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received your Part 289, containing the Strictures on the Cambridge Works. Ought we not to consider the intention (that is, the ostensible intention) of those works, that of forming standard educational treatises for students at that university? As such, they would rather be the expression of the accredited course of reading than the private thoughts of the individual. Cambridge, as the British mathematical university, is certainly bound to adopt any mathematical discoveries (either of invention or combination, as we say of patents,) made there or elsewhere, and digest them into a regular and classic form for her students; and to me it seems better, and I will say, more honest, that whatever is required of candidates for honours should be fairly printed than hoarded up in the MSS. of private tutors, which latter course has always entailed enormous expense for private tuition on, perhaps, the poorest class of undergraduates. Indeed, I was much pleased some time since, having sent for *Wood's Algebra*, to find it amplified since my time into one of the best and cheapest elementary works I have met with for a long time on any subject, containing much that was formerly inaccessible, except at the rate of £60 or £70 per annum. I believe, too, the treatises you speak of are more copious than their predecessors. The editor of *Wood's Algebra* has had the *honesty* (a quality you seem to doubt the existence of at Cambridge) to print all the *answers* to questions extending over 130 pages (besides those interspersed throughout the body of the book,) *instead of publishing a key afterwards at double the price of the original work.* I wish your extensive influence were directed against *this* system, which I believe is by no means peculiar to Cambridge.

I do not mean, Mr. Editor, that what I have said can justify such extreme cases as you have quoted. It is only a plea for mitigation. W. M.

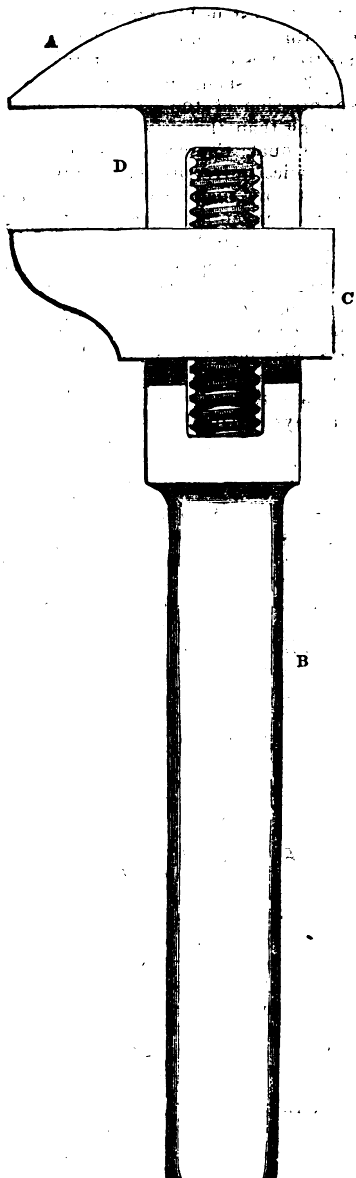
Liskeard.

THE PARSEY —— AFFAIR.

A meeting of the shareholders in this undertaking was held on March 17, at the Thatched-house Tavern, St. James's-street, and was called by the Directors, in compliance with a requisition signed by fifty-one shareholders holding 2000 shares, who desired explanation of the causes of delay in the carrying out of the object, and other information connected with the management of the Company. The meeting was very numerously attended; Mr. Alderman Farebrother in the chair.

It appears that, in 1845, certain gentlemen entertaining (and still in 1847 continuing of the same opinion) confident hopes of the practicability and value of Mr. Parsey's invention for the construction of a locomotive engine impelled by compressed-air power, a Company was organized, and a deed of arrangement entered into, to which the Directors, Mr. Parsey, Mr. Davis (the Solicitor of the Company), and other gentlemen immediately interested, were parties. Amongst other arrangements was one, that Mr. Parsey was to be the Consulting Engineer of the Company, at a salary of 1000*l.* a year, and was to be entitled to half the future profits of the undertaking. The whole capital proposed was 40,000*l.* in 10*l.* shares, whilst the whole amount subscribed was 7853*l.* 8s.; although a larger amount of shares than this sum represented had been issued to parties entitled to remuneration, but who were content to take shares in payment. It will be seen, then, that the Directors had but a limited capital to deal with; whilst, as it was alleged, they possessed a Consulting Engineer of most unlimited genius, and indefinite grasp of design, joined to a not very remarkable uncertainty, and even fickleness, in dealing with the working details of the vast projects in his brain. The Directors, therefore, having to deal with a small capital in carrying out a great design, highly valuable in the projected results, thought it in the highest degree important to proceed cautiously, and step by step; and with that view they decided on giving orders for the construction of a receiver, on the resisting power of which depended, in a great measure, the propriety of the next step to be taken. The construction of an engine according to Mr. Parsey's drawings, would have cost 4000*l.*; the construction of a receiver, on the strength of which, as they and several practical engineers concurred in believing, in opposition to Mr. Parsey's notion, that a great deal depended, would cost only 300*l.* Mr. Parsey was confessedly not a practical engineer; and the Directors thought it better to confide to Messrs. Robinson, who succeeded Messrs. Bramah in the business at Pimlico, the details of the construction of this receiver — which those engineers undertook. Mr. Parsey, it appears, here took alarm, with a sensitiveness natural to the *irritabile genus*—which includes inventors as well as poets—and complained that he had no control over the working

details of this receiver; which, however, it appeared strange to the meeting that *Mr. Parsey denied as not essential to his invention.* It is not our intention to enter into a detail here of the merits or demerits of the invention, or how the strength of the receiver is destined to affect the invention itself. Certain it is that Mr. Parsey and the Directors do not work well together; and that, if they desire to carry out their invention to a successful issue, very cordial co-operation is requisite. In the meantime, we may say, Mr. Parsey made some strong appeals, which appeared to have considerable effect on the meeting. He declared that his duties had never been defined; that he could not bring the Directors to business terms, and was not fairly treated in being refused legitimate control over the working out of his own invention. He had only received 250*l.*; and could not live on prospective advantages, whatever confidence he had of ultimate success.—*Railway Record.*



FENN'S IMPROVED WRENCH.

[Registered under the Act for the Protection of Articles of Utility. Joseph Fenn, of Newgate-street, Tool Maker, Proprietor.]

The improved wrench represented in the annexed engraving is well calculated to sustain Mr. Fenn's reputation as one of the first tool-makers of the day. It is at once the simplest and most efficient instrument of the kind, for all ordinary purposes, which has yet come under our notice. The engraving represents a side-view of this wrench. A is the fixed jaw, which is in one piece with the handle, B; C is the movable jaw, which is slotted out so as to slide upon the parallel part of the handle. The screw shown in the engraving is of the exact length of the mortise, (which is in the parallel sided portion, D, of the handle,) and is greater in diameter than the thickness of D, by which means the threads of the screw take into the movable jaw, which is tapped for this purpose—so that, according as the screw is turned the one way or the other, the jaws are brought nearer to, or pushed further from, each other.

The tops of the screw thread are milled (similar to our gold and silver coins), which enables it to be turned more readily with the fingers.

MEMOIR OF RICHARD TREVITHICK.

(From the *Railway Register*.)

Richard Trevithick was the son of a Cornish engineer, and born, we believe, at Camborne, in Cornwall. He was brought up for the pursuits he followed, in the usual way, as a clerk or assistant in the mine counting-house, having as one of his colleagues, Richard Griffiths, now the chief Government engineer in Ireland.

Shortly after 1790, he joined and assisted William Bull, a Cornish engineer. Bull had been a workman engaged in erecting Watt's engines in Cornwall,* and when the warfare of the mine-owners began to defeat Watt in his patent rights, Bull was one of the engineers employed to fight the battle, and construct engines, which should be beyond the patent. Having obtained the assistance of Trevithick, many engines were made under their united direction, and erected in the county. In 1792, Trevithick was employed to report on one of Hornblower's engines at Tincroft mine, near Redruth. On this he reported, that the duty of Hornblower's engine was as 16 to 10 over Watt's.

At this time the most bitter feeling prevailed in reference to Watt's patent rights. The mine-owners, when they had derived the benefit of the improvement, grudged the remuneration, and the Cornish engineers, with the strong local feeling which then prevailed, looked with anything but pleasure on the intrusion of foreigners in what they considered their country. The Cornish and Welch looked upon themselves as a people by themselves, and upon all English, and all beyond the borders, as strangers and foreigners, whom it was lawful to harass and plunder in any way, and against whom the cry of "one and all" might be rightfully raised. The Cornish engineers participated to some extent in this feeling, and were arrayed as a man in the contest with Watt, in which they were made the tools of the dirty and greedy practices of the mine-owners. The Watt party were able to retaliate in time, and their Scotch adherents have exercised a serious retribution; for wherever the name of a Cornish engineer comes before him, they never fail to decry his claims, and to blacken his reputation. This in a great degree accounts for the neglect of Trevithick, whose share in the Watt quarrel was never forgiven or forgotten, particularly when he became the decided champion of the high-pressure system.†

The history of the Cornish engineers, with the exception of Mr. Stuart's "Anecdotes of the Steam Engine," an excellent and impartial book, has been written only by the Cornishmen themselves; and the valuable treatise by Professor Pole, on the Cornish engine, the Appendix G. to Weale's "Tredgold," must be looked upon as a Cornish work. Thus, but scanty and partial justice has been awarded to such men as Richard Trevithick, Arthur Woolf, Jonathan Hornblower, Andrew Vivian, Jabez Carter, Hornblower, Henry Vivian, Captain Joel Lean, and William Sims. On the life of Richard Trevithick no book has yet been published, and there is only one imperfect memoir, that in the second volume of the *Civil Engineer and Architects' Journal*, though we hope this will be supplied, as the Institute of Civil Engineers have offered a prize for a memoir of the great engineer, which will, we understand, be awarded this session.

After Trevithick's partnership with William Bull had come to a close, he engaged in another with Andrew Vivian, an engineer. Andrew Vivian is said to have been a cousin of Trevithick's, and was the monied partner in the concern, which was carried on at Camborne. In 1802, Trevithick and Vivian, in co-partnership, took out a patent for the application of the high-pressure principle in the steam-engine. This is the era from which the high-pressure engine, in its various forms, takes date, and it deserves a little attention at our hands.

This patent is also the first one taken out for a locomotive engine, and the specification is dated March 24, 1802. The patent is described "as for improving the construction of steam-engines, and the application thereof for drawing carriages on rails and turnpike-roads, and other purposes." It is said that their engine will produce "a more equable rotary motion on the several parts of the revolutions of any axis which is moved by the steam-engine, by causing the piston-rods of two cylinders to work on the said axis, by means of cranks, at a quarter turn asunder." The steam was proposed to be worked either at high-pressure or not.‡ If the former, at a pressure from 60 to 80 lbs. on the square inch, and the boiler was made of a cylindrical form, to bear the expansive action of strong steam, having a bent tube like the letter U within it, to increase the heating surface. The furnace was placed within the boiler, as now in the common

* Pole on the Cornish engine, Appendix G. to Tredgold, p. 37.

† We never heard of such a charge before, and do not believe there is any ground for it.—Ed. M. M.

‡ Ritchie on Railways, p. 205.

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marine boiler. To get a greater draught in the smoke-flue, it was proposed occasionally to blow the fire with bellows, worked by the piston or crank of the engine. The cylinder of the engine was immersed in the boiler, as has since been frequently done.

As a provision against explosion, when high-pressure steam was used, a *second* safety valve was provided, not under the control of the engine-driver, a plan which is now adopted with every locomotive engine.

The introduction of Trevithick's improvement gave increased power to steam, and it is of that importance, that Stuart, no mean authority on historical points, and not likely, from national sympathy, to underrate low-pressure, or over-rate high-pressure, is inclined to date the era of the steam-engine from this invention.* In the establishment of the locomotive, in the development of the powers of the Cornish engine, and in increasing the capabilities of the marine engine, there can be no doubt that Trevithick's exertions have given a far wider range to the dominion of the steam-engine than even the great and masterly improvements of James Watt effected in his day.

That Trevithick's application was original there can be no doubt. He had never heard of Leupold, nor of Oliver Evans, nor was he likely to do so until the close of his life. It is the opinion of the best authorities that Trevithick was the true inventor of the high-pressure system.

Watt conceived the application of high-pressure steam, but was unable to carry it out; he also, in 1769, conceived the use of the locomotive, but never attempted to make one. Oliver Evans also had an idea of applying steam for locomotion. The first locomotive, however, which was made, was that by Trevithick, and it was tried on the common road in the streets of London. The engine used was about the size of an orchestral drum, and was attached to a phaeton, between the back wheels. With this carriage an experiment was made in Lord's cricket ground, at Marylebone, several men of science alternately steering it, and expressing their perfect satisfaction as to the ease with which it was directed.† Hence it was steered down the New-road and Gray's-in-lane, to the coach builders, whence the phaeton had been obtained. Thus, as has been remarked, it passed over the ground since the site of Hancock's experiments, and perhaps destined, in the end, to witness the great triumph of steam locomotion on the common road. The day after the first trial, Trevithick took the small engine and exhibited it in a cutler's shop, working the machinery, which was part of his course of experiment, to show the applicability of the principle for various purposes.

At a subsequent period a temporary tram-road was constructed within an enclosure, on the ground now occupied by Euston-square and the London and North Western Railway, close to that spot where the genius of a Stephenson was one day to complete the triumph of the railway locomotive system. We hope the day is not distant when on the magnificent propylæum of the terminus we shall see statues of Trevithick and Stephenson, looking down on the scene of their peaceful glories.

The tram-road was opened to the public as an exhibition, and on the road, which was of an elliptical form, Trevithick ran his locomotive. Crowds went to see him; but, on the second day, Trevithick, in a freak, removed the engine and closed the place. This he is said to have done under the impression that it was better to let the affair drop until he saw a fitting opportunity to avail himself of it advantageously.‡

In 1804, Trevithick and Vivian constructed a locomotive for the Merthyr Tydvil Railway, in South Wales, to move railway carriages. It was the first railway locomotive. The cylinder was placed horizontally, as in locomotives now used. The heads of the piston rod and connecting rod were divided, or forked, leaving room for the motion of the extremity of the crank, and giving motion to it, fixed on an axle-tree; on this axle cog, wheels were placed, working into cog wheels on the axle of the hind wheels.§ This locomotive engine had only one cylinder of eight inches diameter; whereas, since, the power of the locomotive has been increased to two cylinders of 18 inches diameter. In most essential particulars this engine resembled those now in common use.

At its first trial, Trevithick's locomotive drew, on a level plane, as many carriages as carried ten tons of bar iron a distance of nine miles, without requiring any fresh supply of water, travelling at the rate of five miles an hour.

In February, 1806, Trevithick, in a letter to Mr. Davies Gilbert, states, that he was about to enter into a contract with the Trinity Board for lifting the ballast out of the bottom of the Thames for all the ship-

* Historical and Descriptive Anecdotes of the Steam-engine, by R. Stuart.

† *Civil Engineers and Architects' Journal*, vol. ii., p. 94.

‡ Ibid, vol. ii., p. 94.

§ Ritchie on the Steam-engine, p. 207.

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ping. The first quantity stated was 300,000 tons a year, but they afterwards stated 500,000 tons a year. He was to do nothing but wind up the chain for 6d. per ton, which was then done by men, who never lifted it above 25 feet high. A man could then get up ten tons for 7s.; whereas Trevithick considers that his engine at Dolcoath lifted above a hundred tons that height with one bushel of coals.

He had then two engines already finished for that purpose, and was to be in town in about fifteen days (that is, on the 5th of March, 1806,*) to set them to work. The contract was to be for twenty-one years, and he expressed himself satisfied with the terms. What became of Trevithick's ballast-engines we do not know.

At this time Trevithick had received orders for nine engines within a month, all for Cornwall, and he expected orders for four more.

He was then engaged on a railway, as appears by one of his letters.

From the same source we learn that a person in Wales owed him 600*l.* for patent premium, and disputed his patent.

About 1806, an attempt was made by Trevithick to introduce his patent engine, as a simple non-condensing high-pressure engine, for pumping and winding in the mining districts, in place of the condensing engine of Boulton and Watt.† He considered that the use of his engine would obviate an inconvenience sometimes felt for want of injection water for condensation.

In 1806—we follow Professor Pole's narration—Trevithick had a non-condensing high pressure engine at work, for drawing ores at Dolcoath mine. This was called by the people "a puffer," from its blowing the steam off into the air. This worked well for a time, in comparison with Boulton and Watt's, but did not in the end answer the expectations conceived, so that though he received several orders for engines from the neighbourhood, it is doubtful whether he executed the orders given to him. At any rate, the non-condensing high-pressure engine was never much used.

About this time, Trevithick made the first proposal for introducing the use of high-pressure steam worked expansively to a greater extent than formerly, and substituting, for the common boiler, his cylindrical boiler. This is one of Trevithick's great merits.

In some of the first high-pressure engines manufactured by Trevithick, he used the steam expansively; for in July, 1804, he alludes to the saving of coal effected thereby; but the idea of substituting high-pressure steam in the then existing Boulton and Watt pumping-engine, and of expanding it down to a low-pressure previous to condensation, seems, according to Professor Pole, whom we follow, to have occurred to him about 1806, as above stated. On the 18th of February, 1806, he wrote to Mr. Davies Gilbert for his opinion on the practicability of the plan, and that opinion seems to have been favourable. Anxious to make trial of the plan, Trevithick proposed to adapt a new boiler, of his own construction, to Dolcoath great engine, and to work it with high-pressure steam expansively. He describes minutely, that "it is not intended to alter any part of the engine or condenser, but only to work with high-pressure steam from this new boiler."

Thus, as Professor Pole‡ remarks, Trevithick's plan would, if carried out, have produced an engine nearly the counterpart of those now used. As Trevithick was considerably in advance of his age, his suggestions were not then adopted, and the progress of the steam-engine was thus delayed until a later date. One reason which Trevithick assigns in favour of his plan is particularly worthy of observation. He gives his opinion that the momentum of the vast mass of matter the great Dolcoath engine had in motion, would answer in effect the purpose of a fly-wheel, by regulating the motion of the engine. It is well known, now, that the great mass of matter in the pump-rods, balance-bobs, &c., consequent upon deeper workings, has been the principal cause whereby the modern engineers have been enabled to use expansion to a much greater extent than formerly. This is one among the many proofs of Trevithick's great sagacity and foresight.

During the early part of this century, Trevithick spent much of his time in the metropolis, engaged in promoting his various inventions, and he secured at times the co-operation of many of the active and enterprising men of that day who were acquainted with his merit. Among these associates of his pursuits were the Earl of Stanhope, Mr. Davies Gilbert, Mr. Allen, of Plough-court, Mr. Henry Clarke, Mr. Knight, of Foster-lane, Mr. Taylor, Mr. Nicholson, Mr. Arthur Woolf, and many others.

Among Trevithick's undertakings were included railway and common-road locomo-

* This arrival seems to have been delayed, as intimated in another letter. See Appendix G. to Tredgold.

† Pole on the Cornish Engine, p. 45, Appendix G.

‡ For the account of Trevithick's discoveries in high-pressure steam, Professor Pole's book is the only authority, and he has treated the subject with the greatest ability and impartiality.

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tion, draining, ironmaking, coining, water-pressure engines, dredging machinery, steam navigation, expansion, tunnelling under the Thames, ships' tanks, engines of recoil, and air-engines.*

In 1809, Trevithick was employed in his Thames Tunnel plan, for which a small subscription was raised among his friends for an experimental driftway, as a preliminary to show the practicability of a larger work. The driftway was to be run parallel to the bed of the Thames, and the committee of subscribers felt every assurance of the success of the undertaking, for the operation was very simple, and they had every confidence in Trevithick's ability, and his knowledge of underground works.

This was the second tunnel attempted under the Thames, Ralph Dodd having obtained an Act of Parliament for the first, at Gravesend, in 1799, and commenced his work, but which was soon defeated by water flowing in through fissures in the chalk.

Trevithick's tunnel was at Rotherhithe, a short distance from Brunel's tunnel. He committed the usual error of going too near the bottom of the river, the object being a close run, endeavouring to keep at the least possible distance from it, and to save labour and expense, as the funds were limited. Had his experiment been carried through, he would also have been able to give a plausible cheap estimate of the intended tunnel, leaving the increased expenses to be met as they could. Trevithick's error was not productive of much inconvenience to him, nor does it seem to have been the immediate cause of the abandonment of the enterprise, for he carried his driftway to a greater extent without impediment than Dodd did before, or Sir Mark Brunel did afterwards. It was not until he had gone 930 feet under the river,† that he encountered any obstacle, when he got into a hole in the muddy bottom of the river; and at one time a piece of uncooked ship-beef, which had fallen from one of the vessels, drifted into the works.

Although the Corporation authorities refused to allow him any facilities, he managed to get this hole stopped, and again went on with vigour. He carried on the excavations at the rate of from four to ten feet per day, and soon completed a thousand feet, to the great joy of all parties concerned.

On arriving at this distance, according to a previous arrangement with the committee, Trevithick was to receive a hundred guineas, which, after the verification of the work by a surveyor, were paid to him. According to the memoir in the *Civil Engineers' Journal*,‡ from a contemporary, and the end of which seems to be in perfect keeping with Trevithick's character, the surveyor reported to the subscribers confirming the measurement, but asserting that the line had been run a foot or so on one side. This statement, which, if well founded, was not material, Trevithick took in high dudgeon, and chose to consider it as a severe reflection on his engineering skill. His Cornish blood was excited, and with his usual impetuosity he set to work to disprove the assertion, without any regard to his own interests, or those of the subscribers. He is said to have adopted the absurd contrivance of making a hole in the roof of the tunnel at low water, and pushing up a series of joint rods, which were to be received by a party in a boat, and then observed from the shore. On the prosecution of this scheme, Trevithick was engaged below, and as delays ensued in fitting together the rods, the gulley formed by the opening in the roof at length admitted so much water as to make retreat necessary. With an inborn moral courage, worthy of a better cause, he refused to move first, but sent the men before, and very nearly fell a sacrifice to his devotion. It has been already observed, that the driftway was parallel to the bed of the river, and therefore curved. It necessarily happened, that the water would lodge as in a siphon at the bottom of a curve, at which part, on Trevithick's arrival, he found so much water as hardly to enable him to escape, and as he got up the slope on the other side, and climbed the ladders, the water rose with him at his neck. The work thus ended, after having reached 1011 feet, being within 100 feet of its proposed terminus, and is a melancholy monument at once of his folly and his skill.

On a subsequent occasion, being cross-examined as to this occurrence while witness on a trial, he is said to have admitted the fact of ruining the works, and to have asserted his determination, in any similar circumstance, to defend his own character at whatever sacrifice to other people.

In the spring of 1812, Trevithick was fortunate enough to be able to put his ideas into practice, as to expansive working of high-pressure steam.§ He had occasion to erect a small engine at Wheal Prosper mine, of which he was the sole engineer, and in this engine he took the opportunity of trying the effect of the plan he had so long ago

* Pole on the Cornish Engine, Appendix G., p. 44.

† *Mechanics' Magazine*, Vol. I.

‡ Vol. II., p. 94.

§ Pole, on the Cornish Engine, Appendix G., p. 51.

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proposed. This, Professor Pole says, appears to have been the first *Cornish* engine ever erected; that is the first condensing engine, working with high-pressure steam expansively, and having the present form of boiler. Professor Pole gives a description of the engine, with which he was furnished by Mr. Richard Hosking, of Perran Foundry, who worked it under Trevithick.

The steam-pressure on the boiler was more than 40lbs. per square inch above the atmosphere, there was no throttle valve, the steam valve was large, and therefore when the steam was first admitted into the cylinder, it must have acted with nearly its full force upon the piston. The engine worked, under its usual load, more expansively than was customary, even with engines in modern days, except some erected within the last five years. The steam was cut off at one-ninth or one-tenth of the stroke. When, however, the load was increased, the degree of expansion was accordingly diminished, and the engine was thus made to lift, by the high pressure of the steam used, a load which had never before been thought possible, showing thereby the great advantage which the method employed would offer in adapting the capabilities of the engine to the variable nature of the duty required to be done by it.*

Arthur Woolf also proposed a modification of the expansive principle, and took out a patent for it in 1804. Trevithick proposed his scheme in 1806, and built a Cornish engine on his plan in 1812. Woolf brought his engines into Cornwall in 1813 or 1814.† The success of Woolf's engine for some time delayed that of Trevithick's.

In 1815, on the 6th of June, Trevithick took out a patent for what he called a plunger or pole engine. This engine succeeded very well for a time, but having been superseded by a simpler form it did not survive. The first engine of this kind was put up by Trevithick, at Herland, in 1815, the steam being worked at a very high pressure. In writing to Mr. Davies Gilbert, he asserted its successful trial, but overrating its power, he attemped to make it command the whole water of the mine, a work which would have required two 80-inch engines of the present construction, his engine being a 33-inch. As Professor Pole observes, Trevithick failed in the attempt, as he usually did when he aspired at too much. At a subsequent period, Mr. William Sims purchased the patent right of this engine, and applied its principle in the alteration of several engines, which became for several years formidable rivals to the best engines in the county.

Trevithick had also invented a cylindrical boiler for the generation of steam, having an internal fire tube. One of them he was about erecting in December 1804, in South Wales. It was 24 to 26 feet long, 7 feet diameter, internal fire tube 4 feet 4 inches diameter at the wide end, and 1 foot 9 inches diameter at the narrow end, being very nearly the same dimensions as in the present Cornish engines, except that the fire tube is often made of equal diameter throughout. Mr. Pole observes that the perseverance Arthur Woolf showed in bringing his double-cylinder engine into operation, was chiefly effectual in stimulating the Cornish engineers to avail themselves of Trevithick's plan, by opposing it to the more complicated one of Woolf, and thus to show that it possessed advantages which they had neglected or thought improbable when Trevithick had offered them years before. Woolf himself subsequently adopted Trevithick's boiler.

Among Trevithick's modifications was the adoption of a single cylinder for working the steam expansively. In 1816, Messrs. Jeffree and Gribble, who had been educated under Trevithick, erected a new engine with a 76-inch cylinder at Dolcoath, where Trevithick had been engineer.‡ This was a single-acting Boulton and Watt engine, but was worked with high-pressure steam expansively, supplied from boilers on Trevithick's construction. In the first year it performed forty millions, being a much higher duty than had hitherto been reached by any single-cylinder engine. It long maintained its high character, and, singularly enough, improved as it was more used. In 1817 it reached forty-four millions, and in 1819 was the best engine reported.§

Among Trevithick's plans was an improvement on steamboats by propulsion at the stern, and he suggested the use of a spiral wheel, revolving at the stern, as preferable to the use of side paddle-wheels.‖ The modern extension of this mode of propulsion is well known. Another proposition of his for promoting steam navigation, was his revival of the plan of giving motion to the engines by means of the reaction of the steam made to spout against the atmosphere.

In 1815 he effected an improvement in

* Professor Pole, in Appendix G., p. 52.

† Professor Pole, in Appendix G., p. 54.

‡ Professor Pole. Appendix G., p. 56.

§ Lean's Historical Statement.

‖ It would be more correct to say, that he suggested the use of *the screw*, which has since been so extensively adopted. For though Trevithick was certainly not the first to hint that such a use might be made of the screw, (of which we can readily believe he may have been unaware,) he was, at all events, the first in this country to furnish a clear and distinct plan for carrying the idea into mechanical effect.—Ed. M. M.

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his high-pressure engines, by forming the piston so that a ring of water should run all round it, and render the whole air-tight; as he found in practice that a very moderate degree of tightness in the packing produces this result.*

We now come to a romantic period in Trevithick's life. Uvillé, a Spaniard, seeing the decline of the American mines, from the insufficient power of drainage in the old works, was desirous of adopting the English method of pumping by steam. For this purpose he came to London in 1814, but his efforts were baffled by the difficulty of transporting cumbrous machinery over the mountain districts, and by the diminution of power to which atmospheric engines would be subjected when worked in the rarefied atmosphere of the Cordilleras. To Watt and to other eminent engineers he applied urgently, but without success.

When on the point of departing from England, frustrated in his object, he chanced to see a finished working model of Trevithick's engine exposed for sale in the shop of Mr. Roland, in a street near Fitzroy-square. This model Uvillé carried to Peru, and, to his unutterable joy, he had the pleasure of witnessing its successful working on the high ridges of the Sierra de Pasco.

Thus encouraged in his darling plan, he entered into partnership with two rich merchants at Lima, and obtained from the Viceroy of Peru the privilege of working some of the abandoned mines. He once more started for England, and while on his voyage, talking with Mr. Teague, a fellow-passenger, of his anxiety to discover the inventor of the model, he was most agreeably surprised to hear Mr. Teague answer that "Trevithick was his near relative, and that he could bring them together within a few hours of their arrival at Falmouth."

Accordingly, on his arrival, Uvillé proceeded to Camborne, and had an interview with the great Cornish genius, to whom no undertaking could have been offered which he would have better liked. They readily came to terms; Uvillé remained some months with Trevithick, profiting by his instructions, and, after a tour through the mining districts, proceeded to Soho, but met with no encouragement from Boulton and Watt. Trevithick then undertook to furnish the necessary engines, and set actively to work.

In September, 1814, Uvillé embarked at Portsmouth, for Lima, taking with him three engineers and nine of Trevithick's engines. The names of the engineers were William Bull, formerly Trevithick's partner; Henry Vivian, of Camborne, a kinsman of Andrew Vivian and Trevithick; and Thomas Trevarthen, of Crowan.

Uvillé was received at Lima with the greatest honours and rejoicings, and landed with his cargo under a royal salute. It was not until the middle of 1816 that he was able to surmount the local difficulties of transport, and place the first engine in operation. Trevithick, however, had nobly armed him against the antagonist obstacles, and all that his ingenuity could suggest had been put into practice. The machinery, simplified to its greatest extent, was so divided as to form adequate loads for the weakly llama, and the beams and boilers, made in several pieces, were transported over precipices where a stone may be thrown for a league.

The engine erected at Tauricocha, in the province of Tarma, was put into operation, and, in the presence of the government commissioners, drained the first shaft of the mine of Santa Rosa, one of the Pasco districts. The greatest expectations were created, and amid the profusion of honours showered upon the projectors, nothing seemed to be wanted but the presence of the meritorious inventor himself.

In the meanwhile Trevithick had been actively employed in preparing for his departure. He had constructed several new engines, and an apparatus for the Peruvian mint. He had also directed his attention to a point of the greatest importance in the then scarcity of quicksilver, the purification of silver ore by fusion, for which he constructed furnaces.

In October, 1817, Trevithick gave up all his property in England, and, leaving it to his wife and children, embarked for Peru.

At this time he had successively achieved he application of high-pressure steam, and had greatly increased the duty of the Cornish engine. The locomotive engine, of his invention, was then in practical operation, and had acquired the power of drawing 30 tons, at the rate of four miles an hour, and was found to be capable of surmounting rising gradients. Trevithick was in the zenith of his power, and all that he had promised, and which had been so long delayed by prejudice, was then accomplished; having, indeed, done more than any other man for extending the domain of steam.

In February, 1817, he arrived at Lima, where his presence excited the utmost enthusiasm. He was received with the greatest honours, while the official announcement of his arrival in the government gazette created the greatest expectations among the whole people. He immediately obtained an audience of the Viceroy, and the Lord Warden of the Mines was directed to escort him,

* Historical and Descriptive Anecdotes of the Steam Engine, by R. Stuart, p. 520.

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with a guard of honour, to the seat of his future labours. The chief men of the mining district came many days' journey to Lima to see and welcome him, and all exerted themselves to show their esteem for the well-deserving Don Ricardo Trevithick. Never, perhaps, was European so well received in the New Indies. He was no Las Cases coming to rescue an injured population from oppression, he came as a benefactor in another way, as a man of science to repair their old resources, and to open new mines of wealth. It was the first benefit they had received from the Old World, and no wonder that a warm-hearted people welcomed Trevithick with as much enthusiasm as Columbus had once awoke in Spain.

The exertions of Trevithick were crowned with success, and he was equally rewarded by their profitable return, and by the gratitude of the people. The produce of the mines grew in an unexpected degree, and the coining machinery was increased sixfold. His partners united in expressing their obligations to him, and the authorities showered down honours upon him. He is said to have been created a Marquis and a Grandee of Spain, and the Lord Warden of the Mines proposed to raise a statue to him of massy silver.*

The times, however, changed, political dissensions arose, and civil war broke out: Trevithick's fortunes changed to losses, and he determined to leave Peru; but this was no easy matter, for the veneration with which he was looked upon, as a benefactor sent from Heaven, made the people regard his absence as a public calamity, and take every measure to prevent his departure. At length he made his escape, through dangers which few less adventurous than himself could have encountered; and after escaping the terrors of the mountain and the desert, and the arm of the wandering savage, he again arrived safely in England, landing at Falmouth on the 9th of October, 1827, bringing back, according to some accounts, a pair of silver spurs, as the sole remains of his once great wealth.

The great panic had then cast its gloom around, and Trevithick vainly endeavoured to raise capital to carry out some of his colossal projects. Those who knew his skill feared the waywardness of his character; and those who did not know his ability were repulsed by the giant nature of his enterprises. It was in vain he urged his own success, and represented the boundless resources of the Andean range. While in America he had obtained grants of large tracts of land, and on one estate had a mountain of copper ore, which, like the hill mines of Potosi, or Montserrat, it would take hundreds of years to hew down. Here he proposed to construct railways, and by the aid of capital and machinery, make the shores of the Pacific a grand commercial mart.

From this time little was heard of him, and a few years afterwards he died at Dartfort, in Kent, on the 22nd of April, 1833, leaving no other inheritance to his family but the grandeur of his name and the glory of his works.

Trevithick married a Miss Harvey, a lady of good connections; her brother subsequently acquiring a large fortune. An anecdote is related in connection with this lady, which proves Trevithick's love for her, and his spirit of perseverance even in trifles, for that during his long courtship, and notwithstanding the business in which he was engaged, he never missed walking every evening several miles to visit her.

He left by this lady two sons, both members of the engineering profession.

Trevithick was of a robust and well-proportioned form, and had an expressive countenance. In his manners he was plain and blunt, but not rude; he maintained his opinions with honesty and firmness, and was only in fault that too frequent success made him adhere to them with pertinacity. He had, however, many disadvantages and many defects. The fertility of his invention led him to take more pleasure in imagination than in persevering and carrying out his ideas to a practical result. Thus even before his own departure for Peru, he had abandoned the locomotive to its fate, and left it to the kindred genius of George Stephenson for its accomplishment. The same is to be said of many other of his inventions, that he left others to finish them, while some of his most promising designs went no further than the suggestion. Hence many were inclined to look upon him as a mere schemer, and withdrew their countenance, particularly after they had suffered in his experimental enterprises.

In reviewing his career, and comparing it with that of his great rival, Watt, we are able to appreciate the fortune of the latter, in the steady friendship and co-partnership of Matthew Boulton, a resource which had Trevithick possessed, we do not know that he would have achieved greater results, but he would have enjoyed more reputation in his lifetime, and a better share of this world's

* For the best account of the early part of Trevithick's American career, see a paper by Mr. Boase, in the First Volume of the Transactions of the Geological Society of Cornwall, p. 212.

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goods, while his inventions would have been carried out by himself, and not by others.

Whatever may be the opinion as to his superiority over Watt, or his equality with him, this must be confessed, that next to Watt no other man has yet done so much for the steam-engine as Richard Trevithic k

MR. TREVITHICK'S NEW-ROAD EXPERIMENTS IN 1808.

Sir,—Observing that it is stated in your last number (No. 1232, dated the 20th inst., p. 269,) under the head of "Twenty-one Years' Retrospect of the Railway System," that "the greatest speed of Trevithick's engine was five miles an hour," I think it due to the memory of that extraordinary man to declare, that, about the year 1808, he laid down a circular railway in a field adjoining the New-Road, near or at the spot now forming the southern half of Euston-square; that he placed a locomotive engine, weighing about 10 tons, on that railway, on which I rode, with my watch in hand, at the rate of 12 miles an hour; that Mr. Trevithick then gave his opinion that it would go 20 miles an hour, or more, on a straight railway; that the engine was exhibited at one shilling admittance, including a ride for the few who were not too timid; that it ran for some weeks, when a rail broke and occasioned the engine to fly off in a tangent and overturn, the ground being very soft at the time.

Mr. Trevithick having expended all his means in erecting the works and inclosure, and the shillings not having come in fast enough to pay current expenses, the engine was not again set on the rail.

I am, Sir, your obedient servant,
JOHN ISAAC HAWKINS,
Civil Engineer.

30, Charles-square, Hoxton, London,
March 22, 1847.

MECHANICAL PRINCIPLES.

Sir,—So many of your articles of late have treated of the mathematics necessary for the civil engineer, and so few of their practical applications, that your readers begin to grow a little impatient that you should so long defer coming to the "gist of the matter." Is it too much t hope that you will resume your *Miscellanea Mathematica*, and despatch as speedily as possible the merely mathematical parts of the subjects which relate to our profession; and then proceed to elucidate the *theory* of those branches of mechanical science which more immediately bear upon our own pursuits—both in statics and dynamics?

I will suggest to you one thing: it is, that the foundations of mechanical science should be laid on mechanical considerations rather than on either geometrical or analytical ones. This seems, indeed, from a recent review in your work, to be your own opinion. Pray carry out the principle, and that as early as you can. For instance—give us the *physical idea* of "moments," and of "virtual velocities," instead of the *mathematical abstractions* by which they are represented in calculation. Twenty other cases will occur to you where the same procedure is necessary, both in statics and in dynamics. Let us know what is meant by such "principles" as mechanical modes of action. From these you may deduce (as a good philosophical system requires you to do) the mathematical expressions: whilst, in all the treatises with which I am acquainted, the reverse course is followed—that of mathematical definition as the foundation, and a superstructure of heterogeneous facts raised upon it, so as to suit that foundation.

I will not venture to intrude upon your forbearance by any further remarks; but I do most urgently recommend you to take into consideration the most pressing wants of our profession—wants which you yourself must be aware involve points of this kind more than any other. You would thereby render our "modern mathematics" more intelligible in a few applications, than you could by the most copious dissertations on "Mathematics in the Abstract."

I am, &c. AN ENGINEER.

[Our correspondent is right. After one or two papers more of the *Miscellanea Mathematica* on pure mathematics, we shall be able to adopt his suggestion. In the mean time we earnestly request the favour of any communications on these subjects. They are, indeed, treated by writers on mathematical mechanics in a manner so mystical, that we feel little surprise at the general "mistiness of mind" with which readers rise from the perusal of such works. The task assigned to us is not an easy one; and we shall need every suggestion, especially from *practical thinkers*, that we can obtain. In some fashion or other, at any rate, we shall, ere long, make the attempt.—ED. M. M.]

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CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 285.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

John Marston, of Birmingham, brass founder, and *Samuel Bellamy*, of Birmingham, engraver and die sinker: for a method of stamping upon plated metal, gilt, and other metals, all sorts of hat and cloak pins, and all kinds of figures, decorations, ornaments, and other devices, for cabinet furniture and lock furniture, and intermixing divers colours in the same. Cl. R., 17 Geo. 3; p. 13, No. 14. Aug. 1, 17 Geo. 3; October 29, 1777.

John Jones, of Bristol, iron founder: of a new machine for raising water, or other liquid, by rarified air or steam, being an improvement on such machines, and far superior to the common method of raising water and liquids. Cl. R., 17 Geo. 3, p. 14, No. 6. January 4, 17 Geo. 3; March 5, 17 Geo. 3, 1777.

Antony Mikovinij, of Lewisham, esq.: of a certain new composition for the manufacturing, improving, dressing, and bleaching hemp, flax, and other vegetable substances, and hempen, and other cloth and yarn. Cl., R., 17 Geo. 3, p. 24, No. 16. Jan. 23, 17 Geo. 3; April 19, 1777.

Stephen Dolignon, of Christ Church, (Middlesex,) weaver: for a new method of weaving and cutting the warp shute or brocade floating silk on the right side or face of velvet shag, satin cord, tabby, chain, lustring, or mixture of either of them, plain, flowered, or spotted with flush tissue, tobine, or brocade, with silk, gold, or silver, and silk mixed with cotton, thread, or worsted, so as to form the design, pattern, figure, or stripe; and of staining, printing, or colouring the whole or part of the surface of plain, striped, or flowered silk, or cotton, velvet, long or short piled shag and plush. Cl. R., 18 Geo. 3, p. 2, No. 6. Dec. 31, 18 Geo. 3; April 28, 1778.

Joseph Bramah, of Cross-court, Carnaby-market, (Middlesex,) cabinet-maker: of a water closet, upon a new construction. Cl. R., 18 Geo. 3, p. 3, No. 6. Jan. 27, 18 Geo. 3; May 20, 1778.

John Knox, of Richmond, gent.: of a plan for assurance on lives from ten to eighty years of age upon a twofold beneficial principle, making a certain provision as well for subscribers, or their representatives, upon the death of the person on whose life assurance shall be made within the term assured for, as also by means of a reserved capital for the surviving subscribers whose nominees shall be living at the expiration of such term; and the said scheme or institution is adapted to the different ranks, professions, and circumstances of mankind, wherein subscribers may insure on the lives of themselves, or of others for their own benefit, or that of their assignees, and will, if carried into execution, prove of great advantage to his Majesty's subjects, and likewise contribute to the increase of the public revenues, by a very considerable consumption of stamps. Cl. R., 18 Geo. 3, p. 8, No. 6. July 21, last; Nov. 20, 19 Geo. 3, 1778.

William Baker and *Thomas Baker*, both of Derby, framework knitters: for a new machine or engine for making stockings, waistcoat and breeches pieces, caps, gloves, mitts, purses, and all sorts of hosiery in silk, cotton, thread, and worsted. Cl. R., 18 Geo. 3, p. 12, No. 15. Feb. 3, 18 Geo. 3; May 18, 18 Geo. 3, 1778.

Henry Clay, of Birmingham, japanner: for an invention of making or manufacturing coat, breast, sleeve, vest, and other buttons, japanned, with or without shanks or catgut, or set in cups or sockets of various metals. Cl. R., 18 Geo. 3, p. 12, No. 14. Feb. 5, 18 Geo. 3; May 30, 1778.

Thomas Bean, of Stokesley, Cleveland, cordwainer: of an invention of shoes, clogs, and pattens, called the Cleveland Shoes, Clogs, and Pattens, [whereby shoes made with the longest quarters or shortest forefoot may be worn with clogs or pattens, and with the largest buckles, with ease and pleasure]. Cl. R., 18 Geo. 3, p. 25, No. 8. March 6, 18 Geo. 3; May 29, 18 Geo. 3, 1778.

Francis Gillanders, of Red Lion-street, Clerkenwell, enameller: of a method of covering artificial teeth, and also decayed natural teeth and gums, with a composition or substance that will admit of being coloured so as to imitate the natural teeth and gums, and that will not corrode, stain, or lose its colour in the mouth. Cl. R., 19 Geo. 3, p. 1, No. 3. Oct. 22, 18 Geo. 3; Feb. 19, 1779.

John Bacon, of Covent-garden, (Middlesex,) chemist: of a new invented medicinal preparation for the more safe and speedy cure of intermitting and nervous fevers, and consumptive disorders. Cl. R., 19 Geo. 3, p. 1, No. 1. January 20 last; March 19, 1779.

Thomas Howard, of St. Paul's Churchyard, London, ironmonger: for a warming pan, made of steel, iron, or other metals, of an entire new construction. Cl. R., 19 Geo. 3, p. 2, No. 15. November 24, 19 Geo. 3; March 23, 19 Geo. 3, 1779.

(*To be continued.*)

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LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
Feb. 25	977	Hesketh Hughes	1, Cripplegate-buildings, London.	Protection rouche tray.
26	978	John Edward Smith & Co.	11, Wood-street, Cheapside, London	Shirt.
,,	979	James Thomas Woodman	Walton-on-Thames	Portable self-adjusting leg and foot rest.
,,	980	John Jones	127, Goswell-street	Mortise and tenon-cutting machine.
,,	981	James Tonkin	315, Oxford-street	Angle-piece for iron bedsteads.
27	982	Edward Hill	Park-terrace, Liverpool-road, Islington, mariner	Universal jointed stand, for supporting the blocks or shapes used by milliners.
,,	983	George Firmin	Fordham, Essex, engineer	Boot-stretcher.
March 2	984	John Weiss and Son	62, Strand, surgical-instrument maker	Improved inhaler for the vapours of ether, iodine, &c.
3	985	Ahrend Kohne	Lawrence Pountney-lane, stay-maker	Ladies' spring dress improver.
4	986	Fenton and Marsdens	Sheffield	Improved brace-heads.
,,	987	Philip Le Capelain	Chancery-lane	Reacting halter for horses.
5	988	M. Salt and Son	21, Bull-street, Birmingham	Portable regulating ether inhaler.
6	989	Richard Bright	37, Bruton-street, Bond-street, lamp-manufacturer	Improved lamp-glass holder.
,,	990	Frederick Allen	15, Spencer-street, Birmingham	Fastening for shirt-studs, buckles, brooches, and buttons.
9	991	Samuel Ghrimes	71, Baker-street, Portman-sq., dentist	Concentric cylinder ether and spirit inhaler.
10	992	Samuel Fox	Stockbridge Works, Deepcar, near Sheffield	Improved rib for umbrellas and parasols.
,,	993	George Wilson	York, glass-manufacturer	Ether vapour inhaler.
,,	994	Alfred Nevill & Chas. Richard Hughes	121, Wood-street City	Shirt.
11	995	Miller and Sons	179, Picadilly, London	Lamp.
,,	996	Robert Forsyth Wade.	The Congreve war-rocket manufactory, West Ham, Essex, and 14, London-street, Fenchurch-street, London	Perlucidus signal light.
12	997	William Woolford	Bramley, near Leeds, stuff-presser	Improved oven for heating plates for finishing or glossing woollen and other fabrics.
13	998	Joseph Bothway, R.N.	Union-street, Plymouth	Internal iron strapped wood block.
,,	999	Smith and Gibbs	Wellingborough, Northamptonshire	Cambridge Albert shoe.
15	1000	James Northage Holbrook and David Dyer	Salt-house-lane, York; Stamford-hill, Middlesex	Fastening for buttons, studs, brooches, &c.
16	1001	Edward Sparkhall	142, Cheapside, Lithographic Printer	Pocket pantagraph.
,,	1002	W. and T. Avery	Birmingham	Apothecaries' weights.
19	1003	Samuel Woollart	Aston Bury, Herts	Improvement in horse-shoes.
,,	1004	John Tattersall Cunliffe, James Henry Cunliffe, and William A. Burslem	21, Church-street, Manchester	Improved picker for power-looms.
20	1005	John Blackwell	Northampton	Apparatus for inhaling ether, &c.
22	1006	Richard Bright	37, Bruton-street, Bond-street	Self-regulating lamp-spring.
,,	1007	James Bosnell; John Naylor	Goole, Yorkshire; Winterton, Lincolnshire	Hand truck, or barrow.
,,	1008	Joseph Webb	23, Roman Road, Old Ford, Middlesex	Safety envelope lace wafer.
23	1009	Joseph Fenn	Newgate street, Tool-maker	Improved wrench.
,,	1010	D. Cook and Co.	Commerce-street, Glasgow	Cane punt.
,,	1011	William & John Led	Bloomsbury-place, Wolverhampton	Double safety lock.
,,	1012	Messrs. Robinson	Commercial Road East	Shirt.
25	1013	Wm. Marwick Michell,	Ufston Road, Kingsland	Single crutch illuminator.
,,	1014	Henry Fearncombe	Wolverhampton	Shower bath.

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Roberts's Suspended Mortar.—Portsmouth, March 12.—The experimental trials of Lieutenant Roberts's (Royal Marine Artillery) invention of firing a 12-inch mortar, suspended between two stanchions, instead of using the present mode of having it fixed in a solid bed on the deck of a ship, took place yesterday at St. Helen's, on board the *Curlew*. A considerable number of both services were present to witness the experiments, which were found to answer admirably. Upwards of twenty shells, filled with sand, were fired, the greater number with the full charge of 20lbs. of powder. When fired the mortar described an arc of 60 degrees, and on regaining its position was at 45 degrees. After each discharge the vibrations never exceeded 14 seconds before the mortar was again steady, and the concussions were so slight, that a glass was placed under the mortar and not broken. The rolling of the *Curlew* did not alter the position of the mortar. The plan of fitting a mortar on Lieutenant Roberts's principle is so simple, that in case of bad weather the whole apparatus can be shifted from the upper to the lower deck of a vessel in five minutes. The expense of fitting is trifling, and the mortar is worked with the same number of men.

LIST OF ENGLISH PATENTS GRANTED FROM MARCH 19, TO MARCH 25, 1847.

Peter Britus Coxon, of Lenton, Nottingham, machinist, for a new method of embossing, raising, and forming ornamental figures and designs on certain intertwined textile fabrics. March 19; six months.

John Leslie, of Conduit-street, Hanover-square, one of the tailors to her Majesty's household, for improvements in the combustion of gas for the purposes of light. March 22; six months.

Charles Fox, of Trafalgar-square, Charing cross, engineer, for improvements in the permanent way of railways, and in carriages to be employed on railways. (Being a communication.) March 23; six months.

Henry Kempton, of South-street, Pentonville, Middlesex, gentleman, for improvements in copying presses. March 23; six months.

Henry Smith, of the firm of H. Smith and Co., of Stamford, agricultural implement makers, for certain improvements in machinery for cutting and separating vegetable substances; also improvements in the construction of machines for dibbling, and sowing seed, and distributing vegetable substances and manure over land, part of which improvements is applicable to wheel carriages in general. March 23; six months.

William Bullock Tibbits, of Braunston, Southampton, gentleman, for certain improvements in obtaining and applying motive power. March 23; six months.

Henry Heycock, of Manchester, merchant, for certain improvements in rotary engines to be worked by steam, or other power, which said improvements are also applicable to raising or forcing fluids. March 23; six months.

Morris Lyons, of Birmingham, chemist, and William Millward, of the same place, silver operator, for certain improved alloys of metals, and improvements in the deposition of metals. March 23; six months.

George Fergusson Wilson, of Belmont, Vauxhall, Surrey, gentleman, for improvements in the production of light, and in the manufacture or preparation of materials applicable thereto. March 23; six months.

Henry Hatcher, of the Strand, civil engineer, for improvements in electric telegraphs, and in apparatus connected therewith, and also in electric clocks and time keepers. March 23; six months.

Francois Stanilas Meldon de Sussex, of Millwall, Middlesex, manufacturing chemist, for improvements in smelting copper and other ores. March 23; six months.

William Bruce, of 4, Essex-court, Temple, and of Flimstow, near Pembroke, barrister-at-law, for improvements in constructing piers, breakwaters, and other submarine works of stone. March 25; six months.

Advertisements.

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

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(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

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Patent Metal-Cored Railway Sleeper Company.

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It is remarkable that, whilst great improvements have year after year been made in locomotive engines, the construction of the road upon which those engines are to run has remained without any improvement since the time when the Liverpool and Manchester Railway was made.

The great improvements which have been introduced into locomotive engines have now, however, rendered it absolutely necessary for engineers to turn their attention to the best means of improving the construction of what is called the permanent way of railways.

With a view to such object this Company has been projected, for the purpose of introducing a new kind of railway sleeper, which has been patented, and which embraces many advantages, besides those of economy and unlimited durability. They have been tested on the London and North-Western London and Birmingham) for the last ten months and for which line a further quantity are in course of manufacture.

Prospectuses, setting forth many of such advantages, and forms of application for shares, may be had at the offices of the Company, 1, Guildhall-chambers, Basinghall-street, where specimens of the sleepers may also be inspected.

March 4, 1847.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

Spence on the Specification of a Patent.

THIS Day is Published in 8vo., price 7s. 6d. boards, A Treatise on the Principles relating to the Specification of a Patent for Invention, showing the standard by which the sufficiency of that instrument is to be tried. By William Spence, Assoc. Inst., C.E., Patent Agent.

London: Stevens and Norton, 26, Bell-yard, Lincoln's-inn, and 194, Fleet-street.

The Gutta Percha Company

INVITE the attention of Engineers, Machinists, Mill Owners, &c., to the PATENT GUTTA PERCHA DRIVING BANDS, which possess the valuable properties of great durability and strength, permanent elasticity, and uniformity of substance and thickness, thus avoiding all the irregularity of motion occasioned by piecings and inequality of thickness on leather straps. They are not affected by fixed Oils, Grease, Acids, Alkalies, Water, &c., and possess extraordinary facilities for being joined, and hug their work in a remarkable manner. Can be had of any width, substance, or length, without joints.

The Company continue to receive most satisfactory Testimonials of the superior quality of these Bands, which can be seen at the Company's Works, Wharf-road, City-road, where all orders will receive immediate attention.

E. GRANVILLE, Manager.

London, March 3, 1847.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

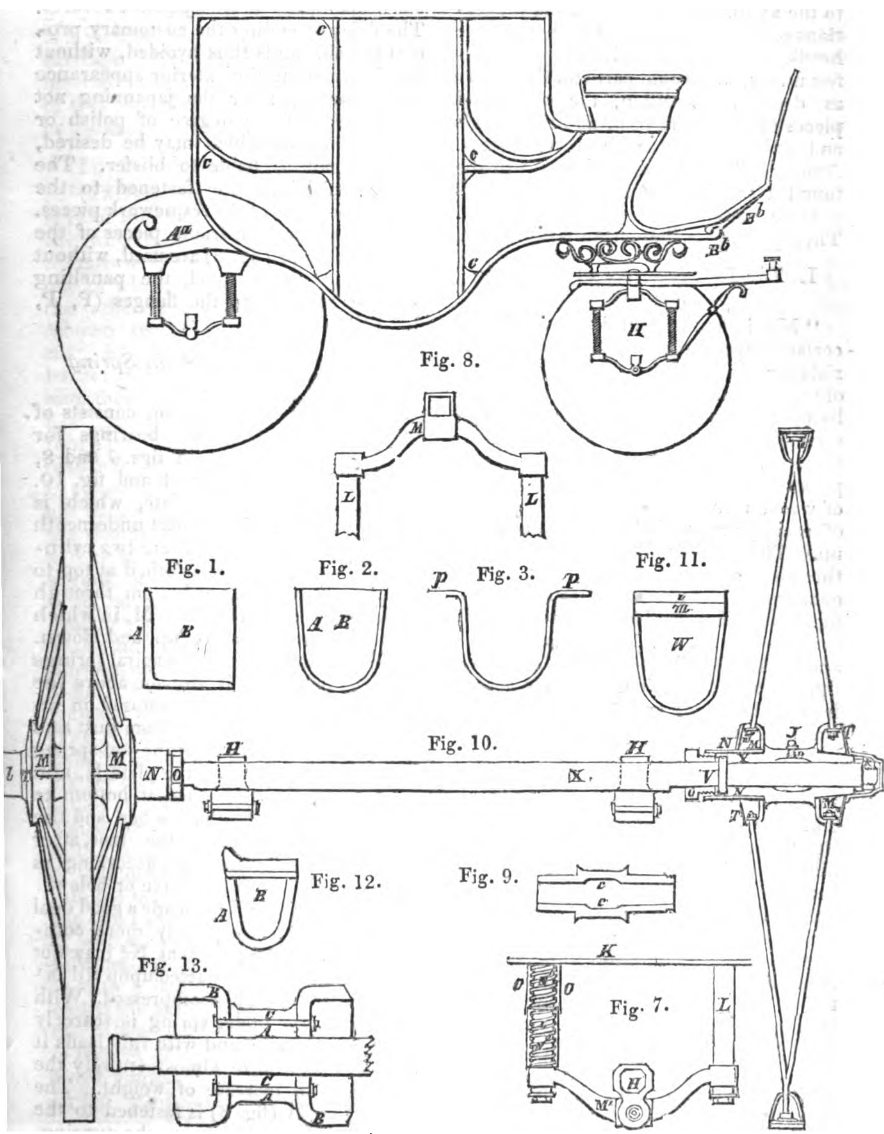
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1234.] SATURDAY, APRIL 3. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

AITKEN'S PATENT IMPROVEMENTS IN CARRIAGES.

Fig. 4.



AITKEN'S PATENT IMPROVEMENTS IN CARRIAGES.

[Patent dated 15th August, 1846; Specification enrolled 15th February, 1847.]

The improvements comprehended under this patent have relation, *first*, to the materials of which the bodies of carriages are composed; *second*, to the spring bearings; *third*, to the wheels; and *fourth*, to the axles. Several ingenious suggestions will be found under each of these heads, and some of which are of manifest utility. We would particularly specify as deserving attention, the compound pieces of wood and iron, and the wheels and axles formed with these pieces. Among Mr. Aitken's wheels will be found a "noiseless" one, which bears a close resemblance to that of Mr. Thompson, described in our last number.

I. *The Improvements in Carriage Bodies.*

"My invention consists, *firstly*, of certain improved combinations of materials for the formation of the body parts of two and four-wheeled carriages, whereby the same may be rendered lighter and stronger than as at present usually constructed. I make the framework of pieces composed partly of iron and partly of wood, using the iron for the outsides of each piece, and the wood as a filling up. The iron for framework I make of three different forms; first, of the form commonly known as angle iron, of which fig. 1 is a cross section; second, of a U form, of which fig. 2 is a cross section; and third, of a flange U form, of which fig. 3 is a cross section. Each piece of iron of the figs. 1 and 2 is filled up with wood, of a thickness equal to the greatest breadth of the iron. The parts marked A in each of these figures represent the iron, and those marked B the wood. The iron of the flange form, shown in fig. 3, may be used with or without a filling up of wood. Fig. 4 is a side elevation of the framework of a carriage, the whole of the parts of which consist of angle iron and wood of the form fig. 1, with the exception of those marked A*a* and B*b*, which are of the U form, fig. 2. *c c* are the gushet-plates by which the different pieces are united. The panelling is made wholly of iron plates riveted or screwed on to the outside of the framework, the rivet-heads or screw-heads being covered with hollow mouldings to mark the divisions between the panels. Instead of painting the carriage constructed of iron in the manner described, I japan the iron either before or after the parts are put together, the drying taking place in an oven, after the usual manner of drying japanned wares. The delay attending the customary process of painting is thus avoided, without any detriment to the exterior appearance of the carriage; for the japanning not only admits of any degree of polish or shade of colour which may be desired, but will not be liable to blister. The inside finishings are fastened to the wooden portions of the framework pieces. In cases where iron frame pieces of the flanged U form (fig. 3) are used, without any filling up of wood, the panelling may be attached to the flanges (P, P, fig. 3.)"

II. *The Improvements in Spring Bearings.*

"*Secondly*, my invention consists of certain improved spring bearings for carriages, represented in figs. 7 and 8, and also in part in fig. 4 and fig. 10. K (fig. 7) is an iron plate, which is fastened at the hinder part underneath to the carriage body. LL are two cylindrical tubes, which are attached at top to the plate K, and pass at bottom through the eyes of a shackle bar M, in which they are free to move up and down. Each of these tubes has two spiral springs N N^2 slipped over it, the one above the other, and each spring is enclosed in an outer tube O, to protect it from dust and injury. The outer tube of the top spring N^1 is attached at top to the plate K, and the under tube is attached at bottom to the eye-piece of the shackle bar, and the two tubes slide one within the other, after the manner of a telescope, according as they are acted on from above or below.

"The top spring N^1 is made a good deal slighter, and consequently more compressible than N^2; so that N^2 may not begin to be materially acted upon till N^1 has been considerably compressed. With light loads, the under spring is scarcely acted upon at all; and with full loads it serves to neutralize almost entirely the effect of the increase of weight. The spring bar M (fig. 8) is fastened to the spring beam which crosses the turning,

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or, as it is technically termed, the '*transmit*,' in the manner shown at H, in the fore part of fig. 4.

"The foregearing of the turning part is the same as in ordinary carriages, with the exception that it is made of U iron fig. 2.) The shackle H is coupled to the axle (as shown in fig. 10,) and attached at bottom to the shackle bar M^1 by a pin on which it turns freely. Fig. 8 is a view of the spring bar of the fore carriage. The spring cylinders LL are inserted at their upper ends into the eyes of this bar, instead of into a plate K, as in the case of the hind bar."

III. *The Improvements in Wheels.*

"*Thirdly*, my invention consists of two several improved modes of constructing the wheels of carriages. Fig. 10 is a transverse elevation of a pair of wheels, one of which is represented entire, and the other in section. Y is the bush (shown separately in fig. 9), which is cast on a mandril, for the purpose of hardening the rubbing parts, or cast soft, and then bored out and case-hardened; *c c* are recesses for holding oil to lubricate the axle; at top there is an orifice for the admission of the oil, which is closed by a thumb-screw pin J. MM are flange-plates of a saucer form, which are shrunk on hot to the bush Y. N is a tube of malleable iron, which is also shrunk on hot to the inner end of the bush, but projects about an inch and a quarter beyond it. The projecting portion of this tube (N) is screwed inside for the purpose of receiving the screwed end of a brass nut O—made in two halves—which is of inside diameter a little larger than the diameter of the collar V of the axle X, and made at its outer end four, six, or eight sided, to allow of the application of a screw-wrench to it. But previously to inserting and screwing up the nut O, a washer of leather, gutta percha, or sulphurized caoutchouc, is introduced into the bush, for the purpose of making the latter more certainly oil-tight. A nut *k*, with washer, is also screwed on to the fore end of the axle, and the whole covered in with a brass cap *l*, whereby the fore end of the axle is also made oil-tight, and the axle secured to the wheel. The felloe is formed of a combination of iron and wood, similar in form to that represented in fig 2, before described. In order to obtain the iron of the required shape, I take a piece of good iron of a length equal to the circumference of the proposed wheel, and of a suitable thickness, say an eighth of an inch, and pass it between a pair of rollers, one of which has a deep groove of the U form, and the other a projecting bead or fillet, which takes into that groove, and is of the same form, but in reverse, simultaneously wherewith the iron is subjected to a third roller to give it the curvature of the wheel. I then join the ends by a short piece of iron of the same form laid inside, which is then secured by riveting, and afterwards hard soldered. I next take a piece of wood of a form and size corresponding with the hollow of the iron ring, and bring it by steaming to such a degree of flexibility that it may be readily pressed into the hollow of the ring without injury to the latter. I then place this compound ring, or felloe, of iron and wood in a drying stove for a short time, in order to expel any moisture which may be in the wood, after which it is then taken out and coated with white lead or coal tar. The felloe is next made fast to the nave in manner following:—Instead of making use of single spokes for the purpose, as usual, I substitute for each single spoke a double one, that is to say, a spoke formed of two rods, the ends of which are secured to the nave, and the other ends are welded together, and form one in the felloe. The form of these double spokes is shown very clearly in fig. 10. These rods are in the case of a 5 feet, or a 4½ feet wheel, of about three-eighths of an inch iron, and for smaller or larger wheels are proportionally diminished or increased in diameter. At their lower ends they are passed through the flanges of the saucer-shaped pieces, M, of the nave, and made fast there by nuts, between which and the iron ring, a ring of leather, or gutta percha, or sulphurized caoutchouc, is interposed in order to give greater elasticity to this portion of the bearings. Metal washers are introduced between the nuts and the leather, or gutta percha. or sulphurized caoutchouc rings or washers. T T, (fig. 10,) are circular plates of sheet iron which serve as side facings to the nave, and prevent the nuts from turning. The welded end of each pair of rods is

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passed both through the iron and wood of the felloe, and made fast by round nuts with broad oblong flanges, which rest upon the tops of the wood into which they are sunk flush. The periphery of the felloe is next cased with wood of from an eighth to a quarter of an inch thick, and of width sufficient to cover both the wood and iron of the felloe, as shown separately in fig. 11, where *i* represents the iron, W the wood, and *m* the outer wooden casing. The iron tire is finally put on above the wooden casing (*m*) in the usual manner. The wheel being now so far complete, is brought up to its proper state of tension, and to a perfectly circular form by means of the nuts, and then slipped on the arm of the axle, to which it is to be applied. By combining in the manner which has been described, iron and wood, a wheel may be constructed, having superior qualities as to lightness and strength than if it were made wholly of either material, and possessing also considerable elasticity. This form of construction offers besides great facilities for making repairs. Supposing it is the tire which wants repair, as the wooden casing (*m*) is the only part which is at all injured by the putting on of the tire in a red-hot state (the wood of the felloe beneath remaining perfectly untouched), it is the only part which needs to be replaced at the same time. When, again, the spokes, or any of them, require to be replaced, this can be readily done without disturbance to either felloe or tire. The nuts by which they are secured to the nave have simply to be loosened (the plates, T T, being temporarily removed for the purpose), when the bend of the spokes allows of their being taken altogether out of the nave, after which they are turned round and unscrewed from the broad-flanged nut which connects them to the felloe. And by pursuing in an inverse order the same course of operations, the new spoke or spokes may be as effectually fixed in, as if they had formed parts of the original structure. The nuts belonging to the nave are for greater convenience made all of one size and pattern, and may be used a great many times without requiring to be replaced. The broad-flanged nuts of the felloe are never moved at all from their original places, and will last as long as the wheel lasts. The felloe might be made entirely of wood, and in one or more pieces, and the wheel constructed in all other respects as before described; but I prefer the felloe composed of a combination of iron and wood, as aforesaid. In the case of railway wheels, the felloes should be made in every respect the same as those of common-road carriage wheels, and have a flanged tire of the usual railway form. A cross section of a felloe and tire of this description are given in fig. 12. A longitudinal section of a nave or boss, also suitable for railway wheels, constructed according to my said improvements, is given in fig. 13. It consists of a central piece of cast iron, AA, to which the two concave or saucer-shaped pieces, BB, for the reception of the arms of the wheels, are secured by bolts and nuts, CC. The second mode of construction embraced under this head of my invention is a modification of that which has been just before described, and has for its object the production of a noiseless wheel. In this case, I dispense with the iron tire altogether, as also with the wooden casing on which it is shrunk, and substitute a tire of sea-horse leather, gutta percha, or sulphurized caoutchouc, which I imbed in a recess made in the compound felloe before described, by reducing the wooden part thereof. The leather tire may be coated with tar, mixed with sand of a coarse grain, or done over first with the tar and then with the sand."

IV. *The Improvements in Axles.*

"*Fourthly*, and lastly, my invention consists of a compound axle for carriages of the following construction:—I take a piece of the best plate iron, about a quarter of an inch in thickness, four and a half inches in breadth, and of half the length of the required axle, varying the breadth and thickness of the material according to the strength of the axle required. I form, by means of welding, as much of one end of this piece into a circular tube as will suffice for one arm of the axle. I turn this circular part in a lathe, and fit it with a screw at its outer extremity, for the reception of the nut by which it is to be ultimately secured to the wheel. About two inches from the inner extremity of this circular end there is a collar

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welded upon it. The remainder of the piece of iron is not made circular, but of the U form represented in fig. 2, only that the open part is placed at the bottom instead of the top. I then take a second piece of iron of the same kind and dimensions, and formed into the same shape as that just described, and weld the two pieces together at their inner extremities, so as to form them into one. I then insert two pieces of straight-grained wood, such as oak, ash, or lancewood, which at their outer ends, fit exactly the circular arm parts of the axle, and are driven tightly into the same, and at their inner ends are scarfed together. From the points where the circular arms terminate on the inside, the wood is kept a little under the edges of the U iron, to allow room for the insertion of a flat plate, which is joined at each end to the circular arms. The whole of the parts of the body or centre of the axle, that is to say, the outer iron casing, the flat plate, and the wooden pieces within, are then firmly secured together by rivets, passed through and through. The pieces of wood are well coated with paint, or some other suitable priming, before inserting them in their places."

ROTARY ENGINES.

Sir,—As a constant reader and present subscriber to your very valuable magazine, I take the liberty of sending you my own crude ideas on Rotary Engines, and will feel obliged by your according them insertion.

I am greatly in favour of simplicity in engines; and I have regretted much to find success has not yet been arrived at in the construction of the various rotary engines, or "whirligigs" (see Mr. Baddeley), which have been before the public. Where such eminent men as Beale and others fail, it is almost madness, in one so unskilled as myself, venturing even a suggestion. However, for once, assurance shall carry me through; and as I only write for information and instruction, I will run the risk of being sneered at. I take for my guide, as far as is practicable, that line in Horace: "Sit quod vis simplex duntaxat et unum." And I am endeavouring to draw a plan of my engine, which I hope to send you by next mail. In meantime, let your readers "chew the cud of reflection" on the following principle:

An iron cylinder, working horizontally, containing inside a screw, at that angle which experiment would show to be best adapted. As far as I have yet gone with my calculations, I have reason to believe that it will be found to work with very little friction—unchecked by cranks, and a multitude of other "*power destroyers*," which are inseparable from other engines.

On communicating my ideas on this subject to an American friend, he, to my astonishment, told me that, many years ago, a countryman of his, named James, constructed one, and had it working in his factory in America, but it was VERTICAL, and its excessive rapidity speedily disordered its parts, and induced him to abandon it.

Now, this excessive rapidity could easily be "governed," and its shaking to pieces serves to prove that it was erroneously planned, and very badly constructed.

Some of your numerous and talented correspondents will, I trust, oblige us Antipodeans and the world with their ideas on this subject.

In haste, your obedient servant,

ARCHIMEDES.

Singapore, Feb. 8, 1847.

SCIENTIFIC MORALITY AT CAMBRIDGE.

That our strictures would be unpalatable to many Cambridge men, we anticipated; but that their justice should be *admitted* by so many others, did take us by surprise. We are, indeed, glad to see that narrow caste-feeling and mere apron-string patriotism is merging into a broader and more rational respect for high talent and high principles, instead of being, as it has too long been, a blind devotion to men in high places about *Alma Mater's* little throne. We have written honestly and earnestly; and to those few who, or whose friends, are implicated in the practices we have condemned, no doubt painfully. Gladly would we have been spared the task, and gladly would we even now turn it over to other hands; for it affords us no pleasure to be made the public accusers even in cases where all honest minds applaud our labours, and where very few even object to the manner in which we have executed our duties. However, we must fulfil our

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mission,—a mission, indeed, which we had considered fulfilled already, but which, from various letters, we are taught to consider as yet incomplete.

We thank those of our correspondents who have so courteously expressed their approbation; but it would be considered a mark of weakness for us to publish any one of them. One or two letters of the "bullying" order, from the opposite class of Cambridge men, should, on the contrary, have a place, could we find in them a single fact or a single argument as a set-off against the vulgar intemperance and illiterate composition of those letters. It is a fact of our constant experience, (and not of ours only, but of editors in general,) that the greatest intemperance is always manifested by the illiterate and the ill-informed. Two letters, however, and by far the best we have received in defence of the present Cambridge system of book-manufacturing, are from two of our frequent correspondents. From these we shall give every word that strictly relates to the question under consideration; and we printed in our last number a postscript, (pp. 298-9,) in which a temperate and sensible *extenuation* is offered. We shall, then, make a few additional remarks, which, we trust, will close this discussion. At any rate, except from the authors themselves, against whom our censures are directed, or their *accredited* agents, the case must be very strong, indeed, which will justify us in printing any further correspondence on this topic:

*   *   *   *

Sir,—I observe that in the paper referring to Cambridge books, Dr. Hymers is accused of having stolen De Fourcy's matter without acknowledgment. Now this is hardly just; for the preface to the first edition of *Hymers' Trigonometry* expressly mentions his obligations to De Fourcy; (it is so long since I have seen that edition, that I cannot assert positively it is *De Fourcy's*; but I know it is some French author De —— on the subject which he mentions, and have no doubt it is De Fourcy.) It is true, the second edition has no preface; but this second edition is greatly enlarged and altered I believe: still, it would have been more just to have continued the former reference, although, in truth, it is somewhat late in the day for any writer on elementary mathematics to accuse another of stealing his thoughts—for it is next to impossible to write on so trite a subject as trigonometry without giving the same proofs as preceding writers, who themselves have "stolen" just as much from others. The same remark applies to the *Astronomy*. Hymers *bought the copyright from Maddy*, (so I have been told); and as, moreover, the *plates* are still marked on the corner "*Maddy's* Astronomy," there is no great injustice here. The preceding edition was called "Maddy's Astronomy *by* Hymers" on the title-page. It might, perhaps, be more in accordance with justice and honourable scrupulousness to add in the title-page or preface—"Bought of — Rev. W. Maddy,— &c. Received — W. Maddy."

As to Snowball's works, their character for accuracy, &c., is so low at Cambridge, (being, in fact, nearly out of use altogether now,) that I am astonished Whewell should condescend to complain of being pillaged—if he *has* done so.

In his "Geometry of Three Dimensions," and also his "Spherical Trigonometry," Dr. Hymers has made tolerably free use of "Leroy's *Géométrie Analytique*," without any mention explicitly of his obligation in the second edition—(Johnian books *never have prefaces* to second editions, and very seldom to first—why, heaven knows!) but I believe there is a reference in the preface of the first.

Far be it from me to defend even the remotest tendency to "strut in borrowed plumes;" I am too well aware of the unacknowledged obligations of Cambridge (and other English) authors to French ones; but there is no need to make the matter worse by any misrepresentations, which, in the present case, I have no doubt, were caused by the writer's not having seen the former editions, or heard of the pecuniary arrangements made between Hymers and Maddy.

Although a Cambridge man, I have nothing whatever to do with the university now, and therefore am perfectly unconcerned in whatever may be thought or said of the place or the men. I have, however, observed that the articles published in your magazine from time to time on these matters, bear evidence of having been written by some one who, I imagine, is not very friendly to the "Cantabs," because no notice is taken there of non-academical mathematicians. I am so far from having any great prejudice in these matters, that I have myself written some not very palatable things for the dons of the university, in a paper in ——, on "English University Life," a few years since; but I think that the writer of these articles is sometimes rather unjust—perhaps from want of more

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information; at any rate, I should be sorry to believe that private pique had anything to do with the matter.

As I have no wish to be mixed up with these affairs at all, I have written simply to correct an error, and if you will just mention it to the writer, that is quite sufficient. A few lines in another number will be enough to show your own impartiality on this, as on all other subjects discussed in the magazine, of which love of justice, I consider the articles on the College at Putney a very honourable indication.

Begging pardon for troubling you with so "much ado about nothing,"

I am, Sir, yours, &c.

P. P.

We now give a few extracts from two letters written to us by the other correspondent to whom we referred, and a valued personal friend of our own. They are written with the familiarity of friendship, and were certainly not intended for publication, and we only give them because they contain a stronger statement of the case, in favour of the system, than any of the more formal letters we have received:

* * * *

With respect to Hymers, however, I do know something. I have not seen the Trigonometry referred to; but I think Hymers has done Cambridge *some service* by the books he has published. For instance, his "Analytical Geometry of Three Dimensions" was the first thing of the kind published in England. No doubt you might find the whole groundwork of it in Monge, Leroy, and a few other French works; but what of that? Hymers deserves great credit for bringing a highly interesting branch of mathematics into the common studies of the university; and more than this, he is noted for working up his materials into a commodious form for *writing out*. He is a clever fellow, and I *know* he works hard about his books.

I believe I could at one time write out the whole, or very nearly the whole, of "Maddy's Astronomy." It was our text book, and my copy bears evidence of work; but since then I have met with much of it in other works. I do not think that Hymers should have taken the book decidedly as his own—though, at the same time, when a book is only manufactured cabbage, I can hardly see why it may not be labelled with one name as well as another. Do you know a mathematical treatise that can, throughout, be fairly called an author's own? If you do, I should like to see it. "Walton's Mathematical Problems" is as original a work as any I know, and yet that is mere compilation. Please to remember that Hymers is no great pet of mine; but he is a clever fellow, and has done some real service in the bookmaking line.

Again, in consequence of our having questioned the accuracy of our friend's statement respecting Dr. Hymers being the first in this country to publish a work on geometry of three dimensions, he writes:

Whether his treatise be the first that appeared or not, it was the first that I know of. It came out seventeen years ago. It possesses this merit at least; that it is in a good form for *writing out*—which is no small recommendation for an educational treatise. I am quite sure you will agree with me that many of the French books, notwithstanding the quantity of valuable matter they contain, are sadly deficient for actual use. They are too much in the form and nature of *essays*. For instance, is not the verbose work of "Monge on Descriptive Geometry" quite a bore for a student "to get up" and be examined upon. I think, really, that Hymers deserves the respect of Cambridge-men; and it appears to me that Whewell is trying to make Cambridge take a retrograde movement, that he may leave it at least as bad as he found it. I am very curious to see you complete the article on the *Cambridge Graces*; but take care of your fingers in your meddling with edge tools.

* * * *

We are quite willing to allow the *facts* stated by our correspondents to have due weight in the formation of a judgment: but mere opinions and impressions we count as next to nothing. At the same time, were we disposed to admit mere opinion as of great weight, there are few men to whom we should feel more inclined to yield a deference than the writers of these letters. We, therefore, proceed:

It is remarkable enough that in nearly all the letters we have received, Dr. Hymers is the special topic of discussion. Mr. Snowball is occasionally alluded to apologetically; whilst Messrs. Colenso, Cape, and some others, are left without a single apology; unqualified admissions with respect to them are made by nearly all. We shall, therefore, confine our own remarks almost wholly to Dr. Hymers; although, in order to complete our case against the recent Cambridge system of wholesale piracy, we must mention one other case—that to

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which we alluded at the close of our postscript, p. 158.

A considerable portion of the private tuition in Cambridge is carried on by means of manuscripts drawn up by the private tutor and lent to the pupil. Mr. Hopkins enjoys a deserved reputation as a tutor, and Mr. (now the *Reverend*) N. Griffin was one of his pupils. In this relation, Mr. Griffin had the MS. of his tutor's lectures on optics entrusted to him; he copied it of course, and to this we make no objection. But will our readers believe that the work bearing Mr. Griffin's name in the book-market is scarcely more or less than a printed copy of Mr. Hopkins's manuscript? Will they believe, too, that this liberty was taken without his tutor's permission, without his even being consulted in the matter, and without the slightest acknowledgment or apology? Were it not matter of general notoriety in the university, we should scarcely give credence to such an extraordinary statement; yet it has never been contradicted—is admitted as true—and is even defended by some!

Surely, it is time for the leading members of the university-senate to adopt some measures for expressing their disapprobation of such practices, and their disgust at such discreditable proceedings as we have pointed out. The public character of the universities is not only endangered, but destroyed; whilst, its conservation being entrusted to them, they are quietly looking on, witnessing with apathy the disruption of those moral ties which bind society together. Public morality is scandalised—the confidence of man in his fellow is shaken—and our intellectual and spiritual pastors are allowed to pursue with impunity a career that in a workshop of artisans would not be tolerated for a single hour! What is the Vice-Chanceller about? Why are the masters of colleges and the heads of houses inert? What are the *few truly scientific* members of the university dreaming of? And, finally, how can Dr. Tatham (the master of St. John's) look without shame and compunction upon the large share which the men of *his* college have had in deteriorating the character of the university for honour and integrity? They must all share in the disgrace if they do not publicly repudiate and practically discourage such doings, and that in direct proportion to the power and influence which their respective stations confer upon them. In fact, we know that the respectable members of the university do not scruple to express in strong terms their disapprobation of the system; but this is not enough, and will never eradicate the evil. Their censure must be embodied in their public acts, to be rendered effective; and men who prove themselves insensible to the laws of honour, should be made to feel that public odium can punish where human laws are powerless.

But we return to Dr. Hymers:—and first as to the "Astronomy," of which there have been three editions.

(1.) Elements of the Theory of Plane Astronomy, by W. Maddy, M. A., Fellow of St. John's College, 1826.

(2.) Elements of the Theory of Astronomy, by W. Maddy, M. A., a new edition enlarged and improved by J. Hymers, M.A., Fellow of St. John's College. 1832.

In this edition, Maddy's preface is partly retained, and additions made by Mr. Hymers in the form of an Introduction, and a few occasional alterations.

(3.) The Elements of the Theory of Astronomy, by John Hymers, B.D., Fellow and Tutor of St. John's College. *Second Edition* revised and improved. 1840.

In this edition the name of Maddy is wholly removed from the title-page, and Maddy's preface from the book. There is nothing, in fact, to suggest that any other person than (the now *Reverend*) Dr. Hymers had the slightest hand in its composition; and we think this must be regarded as one of the boldest and most singular examples of wholesale appropriation which the history of authorcraft supplies. It is also a curious but painful coincidence which is furnished by a comparison of the dates of the work with those of Dr. Hymers' university progress. The doctor did not deviate from — what shall we say?—ingenuousness—in his first edition of Maddy, while he was M.A., which does not necessarily imply initiation into holy orders. In the second, which he edited after having proceeded to the degree of B.D. (Bachelor in Divinity is a higher degree than M.A,), the doctor has made the singular appropriation detailed above.

Dr. Hymers has within the least time

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that the statutes of the university allow proceeded to the highest degree which that body can bestow in *divinity*—the ultimatum of all the strictly legitimate university studies. It is very unusual for a young man to ascend to the highest degree while resident in the university, without some good and sufficient provocation—as, for instance, the advancement to a bishoprick, a deanery, the head-mastership of one of the leading public schools, or the mastership of a college. Were such an ascent a real criterion of high merit and fair competition, we could understand the aspirations of a generous ambition to attain it: but being, as it really is, a mere routine and a matter of purchase, like "buying up" in the army, we can attach no idea of personal merit to the man who affixes D.D. to his name. Doubtless, Dr. Hymers has good reasons for becoming a doctor in divinity—the *solitary doctor* amongst the tutors in the university of Cambridge! A doctor in every faculty is by his degree a member of all the standing committees or syndicates—as, for instance, the University Library, the University Press, &c.; and is, therefore, a greater personage than an ordinary master of arts, whose degree, whatever may be his knowledge and ability for university business, does not qualify him to sit at any syndicate with the doctors. We can now understand the petty ambition of this wonderful personage. But ambition is not all: there is emolument too. Of this, however, anon. We must now return to Dr. Hymers's writings.

In October, 1837, the doctor put forth his Trigonometry, in the face of the third edition of Snowball's. Dr. Hymers was then tutor of St. John's College; and Mr. Snowball, though a fellow of the same college, was not tutor. To any candid mind we would ask, Does not the comparison of these two editions most fully support our charges of the *spirit* of Dr. Hymers's publications? In the "Advertisement," after the title page, the first sentence is in these words: "*In drawing up this treatise, considerable assistance has been derived from the Trigonometry of Lefebure de Fourcy.*" This avowal was necessary to prevent the charge of piracy from Mr. Snowball; and to furnish an oblique hint that the latter gentleman had *also* availed himself of the same aid *without acknowledgment.* When he had driven his subordinate and competitor from the field, how does the doctor "do the candid" then? Thus:—in the second edition, and all later ones, he omits the entire advertisement, this acknowledgment, of course, included! The omission of preface, and of all notice of previous writers in works intended for youths raw from school, with the sole name of Dr. Hymers on the title page—more especially those youths who come under Dr. Hymers's immediate tuition—cannot fail to impress them with the idea of their tutor's awful greatness, since he had "made so many, *so many* books of mathematics.' What a glorious ambition!

In 1839, Dr. Hymers published a "Treatise on Differential Equations and on the Calculus of Finite Differences," as usual, without preface or advertisement. We are not now discussing the *value of the matter* contained in any of these books, and will be silent on that subject. Our sole object is to justify our assertions respecting less pardonable conduct than merely writing and publishing a valueless book. It will be recollected, that in aid of the movement of Messrs. Herschel, Peacock, and Babbage in favour of the continental methods, a translation of the lesser work of Lacroix on the Differential Calculus was published by them; and in addition thereto, a most valuable collection of examples in the Differential and Integral Calculus, the Calculus of Functions, and the Calculus of Finite Differences. The last was by Mr. (now Sir John) Herschel, and in all respects a most original and valuable work. Will the reader believe that the substance of this work, and *all* the examples that could be rendered available to the purpose, have been taken in the latter part of Dr. Hymers's unprefaced "Treatise," and without even a foot-note acknowledgment? Whether he will believe it on our authority or not, we care not: let him satisfy himself by a comparison. He will find that the learned mathematical divine has, through his entire mathematical career, been uniform and consistent in his principle—the principle of the "appropriation-clause"—that principle applied to literature which the renowned "Fagin" and the equally renowned "Ralph Nickleby" of the grosser world, so happily applied to the "vipes" and the "warrants of attorney."

(To be concluded in our next.)

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CHAPTERS ON ANALYTICAL GEOMETRY. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from page 293.)

CHAP. V.—*On Cones, Cylinders, and Planes.*

SECTION 1.—*The Cone.* When the first system of intersecting straight lines, mentioned in Section 2 of my third *Chapter*,* coincides with the second system,—in which case the two parallel lines mentioned in the previous Section coincide also, and all the straight lines pass through and intersect in the centre,—the hyperboloid of one sheet becomes a *cone.* This geometrical modification of the surface has a corresponding analytical indication. When the two parallel planes, mentioned in the Section first above alluded to, coincide, the equation which we arrive at by our processes for determining such planes will have its two roots equal. This is merely put by way of illustration. The following are the propositions which I shall use in determining this surface:

If a surface of the second degree can be intersected either (1) *rectilinearly, or* (2) *in a point, by one, and only one, plane parallel to a co-ordinate plane—the position of such intersecting plane being determined by means of a quadratic equation with equal roots—the surface is a cone.*

A cone may always be intersected either (1) *rectilinearly, or* (2) *in a point, by a plane parallel to a co-ordinate plane.*

The equality of the roots serves to distinguish the cone, on the one hand, from the hyperboloid of two sheets and the ellipsoid, which may be touched by parallel planes, and, on the other, from the elliptic paraboloid, whose tangent plane is determined by a *linear* equation.†

Ex. (ε.) What surface is represented by the following equation?

$$x^2+2y^2+3yz-2xy-6x+7y+6z+7=0.$$

(Leroy, p. 158, No. 240.)

Proceeding nearly as at page 293, we have

	x^2	yx	x	y^2	zy	y	z^2	z	1
	1	−2	−6	2	3	7	.	6	7
				−1		−6			−9
			u^2	1	3	1	.	6	−2
								.	.
								24	−8
							−9	−6	−1
					u^2+v^2		−9	18	−9

here $u=x-y-3$, and $v=y+\frac{1}{2}(3z+1)$; the equation in z being

$$-9(z^2-2z+1)=0;$$

hence, since this quadratic in z has equal roots, the given surface is a *cone.* It will be met by the plane in a point determined by the equations $z=1$, $u=0$, $v=0$.

SECTION 2.—*The Cylinder.* This surface may be distinguished by means of the following propositions:

When a surface of the second degree can be intersected in two parallel straight lines by an indefinite number of planes parallel to one another—the parallel straight lines in general varying in their distance from each other with different positions of the intersecting plane—the surface is a cylinder.

A cylinder may always be rectilinearly intersected by an indefinite number of planes parallel to one another;—the intersection being in general in parallel straight lines, varying in their distance as above stated.

The only exception to this last remark is a parabolic cylinder rectilinearly intersected by a plane parallel to its axis.

In discussing the previous surfaces, I have contented myself with simply determining to what species they belong, without considering them more minutely. This omission I shall not here attempt to supply so far as those surfaces are concerned, but the following observations will enable us to ascertain what *variety* of cylinder is represented by a given equation:

In the elliptic cylinder, then, *all the intersecting planes parallel to the same plane must pass through a straight line of finite length.*

In the hyperbolic cylinder none of the intersecting planes must pass through a certain straight line of finite length.

In the parabolic cylinder the number of parallel planes having rectilinear in-

* *Ante.* pp. 271—2.

† It is only for points at an infinite distance from the vertex that the tangent planes can become parallel.—J. C.

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*intersection with it is unlimited in one direction, but limited in the opposite direction.**

In the latter case, however, the cutting plane must not be parallel to the axis. But this case will present no difficulty, inasmuch as the *singleness* of the intersection will enable us to recognize it.

Ex. (ζ.) Determine the surface represented by the following equation:

$$x^2+y^2+9z^2+6yz-6zx-2xy+2x-4z=0.$$

(Leroy, p. 164, No. 249.)

The process in this case may be conducted as follows:

x^2	yx	zx	x	y^2	zy	y	z^2	z	1
1	−2	−6	2	1	6	.	9	−4	.
				−1	−6	2	−9	6	−1
				u^2		+2	.	+2	−1

The proposed equation is therefore equivalent to

$$u^2+2y+2z-1-s^2+s^2=0$$

(where $u=x-y-3z+1$); and if the surface represented by it be cut by the plane

$$2y+2z-1+s^2=0,$$

the intersection of the surface and plane will be parallel straight lines represented by the equation

$$u\pm s=0,$$

and whose distance from one another consequently varies with s. Since s^2 must be positive, we see that these planes may be taken indefinitely in one direction, but not in the opposite direction, and the surface is the *parabolic cylinder.*

Ex. (η.) The equation is

$$x^2+3y^2+4z^2-6yz-2zx=a,$$

(Leroy, p. 164, No. 250,)

what is the surface?

Proceed as follows:

x^2	zx	z^2	yz	y^2	1
1	−2	4	−6	3	$-a$
		−1	.	.	.
		3	.	.	.
$u^2+\frac{1}{3}$ of 3^2			−6,3	9	$-3a$
				−9	
		u^2+v^2		$+\frac{1}{3}$ of	$-3a$

Add and subtract s^2 from this last equation, as before, and decompose the result into the two following equations:†

$$u^2-(a-s^2)=0,\quad v^2-s^2=0,$$

then the planes $v\pm s$ will cut the surface in parallel straight lines whose distance varies with s; but since we are restricted to such values of s^2 as are less than a, the surface is an *elliptic cylinder.* With these examples I shall, at present, quit the subject of cylinders, and proceed to

SECTION 3.—*The Planar Surfaces.* In this case the given equation may be made to appear as the product of two factors, and when the given equation takes this form, the surface represented by it is, conversely, a system of two planes.

Ex. (θ.) Suppose the given equation to be

$$x^2+4y^2+z^2+4yz-2zx-4xy+3x-6y-3z=0.$$

(Leroy, p. 165, No. 251.)

Proceed thus:—

x^2	yx	zx	x	y^2	zy	y	z^2	z	1
1	−4	−2	3	4	4	−6	1	−3	.
				16	16	−24	4	−12	.
				−16	−16	24	−4	12	−9
						u^2	$+\frac{1}{4}$	of	−9

and the surface represents two parallel planes whose equations are $u\pm\frac{3}{2}=0$, where

$$u=x-2y-z+\tfrac{3}{2}.$$

In general the planar surfaces are given by the equation

$$u^2-v^2=0;$$

when $u=0$ or $v=0$ the surface consists of a single plane. In general also the system of two planes has a double rectilinear intersection with any plane; but when the cutting plane becomes parallel to one of the planes of the system, we have a single intersection only. There

* Its relation to the other cylinders is the same as that of the parabola to the ellipse and the hyperbola.—J. C.

† In the equations which follow, u and v may be interchanged.—J. C.

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is a critical case when the cutting plane coincides with one of the planes of the system, and also when it passes through the common intersection or axis of the system. All this will be easily seen. And now, leaving for the present the line surfaces, I shall proceed to the discussion of the point surfaces of the second degree.

(*To be continued.*)

ON THE APPROXIMATE RECTIFICATION OF THE CIRCLE.

Sir,—Perhaps I may trouble you with the following remark on the approximate rectification of the circle—a subject to which the investigations of Mr. Godfray have given additional interest. (See pp. 297—9 of vol. XLV. of this work.) It is with reference to a formula which I gave at page 397 of your last (45th) volume, and the further extensions of which I shall take another opportunity of discussing. In that, not by any means the most general case, it may be worth while to inquire the effect of substituting $C+c$ for C, and determining c, as we did r in the former cases, by the help, if necessary, of auxiliary quantities analogous to our former quantity v*. This, of course, is not the *only* mode of proceeding.

I am, Sir, yours, &c.,

JAMES COCKLE.

2, Church-yard Court, Temple,
March 29, 1847.

ANOTHER IMPROVEMENT IN SMOKING-PIPES.

Sir,—Your correspondent J.M., at p. 272, offers a suggestion for the improvement of smoking-pipes. I beg leave, with your permission, to offer another. J.M.'s suggestion regards the form of the article: mine has reference to the material.

The material I propose is porcelain, in the state which I think is called *biscuit*, that is, unglazed. In this state it retains its porosity, and consequently will be highly absorbent; while its power of resisting a moderate heat will allow of its being purified as often as purification is necessary. It is in this last respect that the meerschaum, which otherwise cannot be excelled, is defective. It does not resist the fire; and therefore, as there is no other method (at least, which I am aware of) of restoring its absorbent property, when it gets foul it becomes useless.

Pipes of the material suggested, I think, could be got up at a moderate price, and I should anticipate a considerable demand for them.

I am, Sir, yours respectfully,

A SMOKER.

London, March 27, 1847.

WATT AND TREVITHICK.

Sir,—Allow me to make a remark upon the interesting memoir of Trevithick, in your 1233rd Number. At p. 308, the writer says, "Whatever may be the opinion of his *superiority!* over Watt, or his *equality!* with him," &c.

Readers are oftentimes so careless, that they receive impressions without due consideration; and the mechanics of this country should never be allowed to take an erroneous one of their greatest master. He stands first, and alone, because he has no equal; and not for an instant can Trevithick be compared to Watt. It is unwise to the memory and talent of the former to raise the question. We owe much to Trevithick, it is true; and, granting that he never heard of Watt's conception "of the application of high-pressure steam," and of the locomotive engine, both of which the writer of the Memoir admits (at page 302) Watt first invented—still Trevithick was twenty years behind Watt in originality. So much noise and jealousy, however, did Watt's inventions create, that we may be

* *Mech. Mag.* vol. XLV. page 396, &c., &c.

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sure that human nature was then what it is now; and that Watt's specification was as eagerly inspected by the engineers of that day, as would a specification be now of a novel invention which promised to revolutionize our whole system of inventive power. It was not (we may be sure, by the great things Watt did,) that he "was "unable," as the writer says at p. 302, "to carry out" the application of high-pressure steam, and the locomotive engine, but that he had no time. In the then barbarous state of the mechanic arts, his labours were so many, and so important, in bringing a portion of his inventions—the most wanted at that period—to perfection, that he was obliged to leave to others to gather up the sweepings of his prodigal talent, from which so many have since made enduring and well-earned reputations. And let us never forget, before comparing any one to Watt, that the principles of all that we now know of steam were not only developed, but their application also pointed out by him.

INVESTIGATOR.

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

Sir,—As there appears to be amongst some of your readers a wish for a few "hints" on the subject of applied mathematics, I take the opportunity of making a few remarks, which, indeed, I had thought of sending to you some time before, with the hope that some self-taught student might derive some assistance from the experience of those who have gone over a part of the ground on which he may be entering. But, before proceeding directly to this object, I wish to make a few observations in answer to the question—more frequently asked mentally than verbally—"What advantage does an engineer derive from the study of mathematics?" And, in connection with this, we are naturally led to the consideration of the practical results *generally* in all branches of science to which the application of mathematics has given rise.

There is, I believe, amongst the great mass of engineers, a very decided conviction that, for any practical good to be obtained, they might as well learn Arabic as mathematics, and, if a practical question be treated mathematically, especially if there be a lot of algebraic symbols mixed up with it, the conclusions arrived at by all this learning are looked upon as "*very fine in theory, but*"—we know the rest. And they very naturally found this opinion upon the inutility of which mathematical knowledge has apparently been hitherto to their profession. A body of intelligent men would never have come to this opinion without *some* ground for it. If it be a mistaken opinion, it is one supported by so many seemingly just reasons, that it is well worth while to go into them, and examine carefully the real state of the case.

Now, in the first place, nothing strikes one more obviously than the fact, that, up to the present time, mathematical investigation has *scarcely been applied to the subject to any extent*, (*i. e.*, by competent mathematicians.) Till within the last fifteen or twenty years mathematicians never dreamt of applying themselves to such subjects. And even now, how many books are there professing to treat of them? About a dozen, at most.

But, secondly, even of what has been done in this way, there is scarcely any portion of which practical men can avail themselves. And the causes are easily enough pointed out. The most prominent of these is the circumstance, that *the application of mathematical formulæ to practical cases requires several things to be known which mathematics cannot teach, and has nothing to do with.* I refer, of course, to the *physical* conditions, such as the strength of materials, &c. Now, until experimenters have done their part, it is absurd to expect of mathematicians that information which necessarily depends on the combined results of calculation and *experiment.* If astronomical *observations* did not exist, what would the science of astronomy be? The dynamical part would consist of a lot of differential equations, crammed full of unknown elements, (such as masses, distances, periodic times, &c.,) all linked together, certainly, and in such a way that, if a sufficient number *were known*, (from *observation*,) the rest could be found out. Now, just so it is with the mathematical science of architecture, &c. If the strength of the beams, the tenacity of the iron, &c., be not determined by experiments, it is the same as if in astro-

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nomy no observations had been made. Until such men as Barlow and Hodgkinson, in England—Morin, Girard, Coulomb, &c., in France—have *observed*, it is of no practical utility for the mathematician to *calculate*—that is, of no utility as regards the application of formulæ to *particular cases*. *General principles* may, of course, be established, just as in astronomy we might be sure (provided we knew the general fact of attraction) that a planet would describe equal areas about the sun in equal times, without knowing anything of the absolute magnitude of the area, or of the time taken to describe it.

But, thirdly, suppose we knew all the elements necessary to be known, the direction and magnitude of all the forces acting, and the geometrical conditions of the question, the *difficulty* of the purely mathematical part of the problem is often very much greater, and almost always of a very *different* kind from what the practical man would imagine. The mechanical phenomena of every-day life are, in nine cases out of ten, immeasurably more difficult than some of those astronomical problems which seem to those unacquainted with them so grand and mysterious. Thus, the spinning of a boy's top is a far more difficult dynamical problem than calculating the orbit of a comet; and it is an easier matter to assign the rocking and pitching of the earth itself, as it rolls on in space, than to calculate the motion of a cricket ball when struck by the bat, or the pitching and rolling of a ship at sea. The familiarity of a phenomenon is anything but a measure of its difficulty; and some of the questions proposed by the engineer as probably the most familiar to him, are very likely to be of the highest order of difficulty, when it is endeavoured to substitute mathematical accuracy for practical approximations.

Except in some few cases (such as suspension bridges, for example, where mathematical calculation is immediately applicable, and experiments have been sufficiently numerous to determine the necessary constants) the present state of experimental knowledge is perhaps of itself sufficient to prevent the theoretical calculations from benefiting the engineer in *particular* cases; it is therefore to those general principles, which are independent of these particular circumstances, to which he must look for benefit, if anywhere. What are these principles then? Are they such that mathematicians only can understand and *use* them, or are they merely what everybody knows from his every-day experience and his common sense, without mathematical assistance?

Many persons seem to have a notion that *mathematical* reasoning is different from any other kind of reasoning: they apparently expect to be all at once enlightened from some mystical source, unapproachable except through a labyrinth of symbols; and, in fact, the expectation of something like *magic* in the matter, is what chiefly allures them to the study, just as a belief in astrology and alchemy used to incite the worthy middle-aged gentlemen to stick so pertinaciously to astronomy and chemistry. This is a very pleasant idea, no doubt; and it is really almost a pity that it should ever have been knocked on the head; for, since then, people have lost all curiosity in these subjects, and, after all, it would be a puzzler for the most "grave and reverend," stiff-necked and exalted *savant* to make out any real distinction between the same "curiosity" and that "love of truth" which they make so much fuss about. I say, then, that it is a pity we cannot all delude ourselves into the good old-fashioned belief that we are on the road to some grand secret, and that, from out of the cloud of mystery in which our operations are enveloped, there will burst forth upon our enchanted vision, some magnificent scene or sublime truth, not to be attained by any ordinary route, or conjured up by any but a cabalistic spell.

Unfortunately, the adventurer in this mystic region very soon finds, that he is obliged to *think*, and that too, in a very ordinary, matter-of-fact sort of way; he finds he cannot *make the symbols think for him*: they are very serviceable "spirits" in their way, and the extent to which that service goes is considerable; but the charm does not reach indefinitely—and, as in the cases to which we are alluding, the real power of the charm depends very greatly in knowing *how far it does extend*. I have said that he cannot make the symbols "think for him," but they do the two following things, which are both of inestimable value:—1st, They chronicle in logical

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order, and in a language of wonderful beauty, perspicuity, and conciseness, his thoughts and reasonings; and 2nd, by their *comprehensive* nature they suggest new forms of the original truth intended to be expressed by them—point out analogies and connections which would never otherwise have been thought of—and, in short, lead to the mine of wealth, although unable of themselves to put him in possession of it. But all these services are only rendered to those who are perfect masters of the symbolical agency. To carry on our simile, they will obey only him who possesses the spell by which they are bound—who knows how to evoke from their mystical answers an intelligible result. Now, the only way to obtain this mastery—the only guide to the signification of these mysterious and, to the uninitiated, unintelligible language, is to become familiar with their use, beginning from the simplest questions. The whole subject of the interpretation of symbols is one of inconceivably boundless extent; it is a subject as yet only in its infancy when compared to what it will very probably one day become. What is termed the "Calculus of Operations" by Professor De Morgan, or the results obtained by the separation of the symbols of operation and quantity, in the differential calculus, is an example of what has recently been done in this subject, but probably only a very small part of what will be hereafter done. The mathematician is well aware of the immense importance of that to which allusion is here made; and the further he proceeds, the more strongly does he become convinced of the necessity of *knowing exactly what his formulæ mean*, from the very first processes of algebra up to the most intricate part of definite integrals. For even the first mathematicians, of the present or of former times, have only been partially acquainted with the full signification of this language—even to them has a greater or less amount of *mystery* remained in it. For example, what *meaning* would Euler himself have attached to the following formula which he, in the course of his numerous dealings with these symbols, *happened* to fall in with:

$$\mathrm{Cos}\,\theta\,\frac{1}{2}\left\{\varepsilon^{\theta\sqrt{-1}}+\varepsilon^{-\theta\sqrt{-1}}\right\}$$

It is only within comparatively a few years that any *attempt* even has been made to give a rational signification to such formulæ. There are many men who have a very good *working* knowledge of mathematics, who, if called upon to translate this into plain English, could give no other version except this, "Cosine of the angle θ is equal to half of a certain number (ε), raised to the power of the angle θ, multiplied by the square root of a negative quantity, plus, &c., &c.," which is what Jonathan would "guess to be a pretty considerable tarnation lot of jargon." These things are merely mentioned as indicative of the importance and vast extent to which the subject of interpretation of formulæ really reaches. A sound and thoroughly rational acquaintance with the real meaning of the equations which are of *most common* occurrence in pure mathematics, and of nearly every one met with in statics, dynamics, hydrostatics, &c., is obtainable without entering on such debatable ground as above alluded to; and the mysteriousness of the formulæ to beginners is only a proof that they have not given sufficient attention to the reasoning by which they are obtained. Some attribute this mysteriousness to the books, some to the readers, and some to the *mode* of reading. There being three parties accused, we must try each, and, as in most cases of this sort, find each guilty of something. It is satisfactory, however, to be able to throw the chief blame on that which has no feelings to be hurt, and could not defend itself if it had—viz., *the mode of reading*. The reader does not *think* enough—the book is not *clear* enough; but the common way of learning from a book, or pretending to learn is of all three "most lame and impotent." Before proceeding to the subject of mechanical principles useful in a practical point of view, we shall return a verdict on each of the aforementioned criminals.

1st. As to the books. Of all the tasks undertaken by mortal man, probably the most difficult, wearisome, and unsatisfactory to all concerned, is the writing of an elementary book on a scientific subject—most especially mathematics. It has been more than once asserted by mathematicians of the highest rank, and no doubt with a full conviction from their own experience, that *the principles* of a science

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are always those which are *learnt last.* That a full, clear, and *comfortable* grasp of those fundamental notions on which a science is founded, is only attained after a long course of intimacy with the *working of the details.* Suppose, however, this vigorous and comprehensive view of the whole is obtained, imagine the difficulty of attempting to place the same view, in its wide extent and clear light, before one who comes without any preparation, and as it were, out of Egyptian darkness! The thing must *necessarily* be done in *detail;* and it is this very disjointedness, and partial-glimpse sort of way, which causes the obscurity. Euclid is perhaps the only portion of the scene which can be compared to a progressive panorama, where each part is clear and intelligible of itself, and view after view opens in lucid order and harmonious connection with what has preceded. Statics and dynamics, on the other hand, are *tableaux*, which require to be gazed at and comprehended *piecemeal*, before the unity of the whole design is grasped, and the whole science taken in at one glance. Thus there must of necessity be many things of which the use cannot be seen, even if the meaning be understood, until a subsequent portion throws light on what went before, and each element finds its place in the final structure.

It has often appeared to me, that the only natural method of conveying a thorough knowledge of a general principle is to commence with the simplest example of such principle which can be found, and conduct by a series of wider and wider generalizations up to the principle itself. The exact contrary is the method usually employed. A general principle or theorem is enunciated in its most abstract terms; which terms themselves are seldom understood until after the student has seen the application to a particular case. In no part of mathematics is this more obvious than in analytical mechanics. But this is not all, or even the worst part of the charge: the one great and glaring defect in nine treatises out of ten, is the utter deficiency or miserable supply of elementary examples. One single example, or problem, carefully worked out, would do immeasurably more to clear up obscurities than ten thousand pages of *general* writing about it. The historical order in which the various theorems have been discovered, is not, *in every case*, the best adapted for the presentation of them to the beginner; but the general arrangement would, in most cases, be very greatly improved by a reference to this historical order. For example: the nature of the differential calculus would be set in a clearer light by introducing the mode of applying it to the finding of tangents to curves, and some cases of maxima and minima, before the great mass of the abstract theory which is usually made to precede all application. And such was the historical order, the general method of application to tangent being known long before Taylor's theorem, &c., were discovered. Dr. Ritchie has undoubtedly gone the right way to work in the little work on the Differential and Integral Calculus which bears his name; although he has unfortunately very much limited its value by leading his readers (perhaps unintentionally on his part) to suppose that the solutions of his problems depend on the *uniformity* of the motion which he everywhere mentions: thus confining the application of the calculus to very narrow limits indeed. Nevertheless, it is the most likely book on the subject to give a beginner any notion of what the differential calculus really is good for, (with the exception, perhaps, of a recent book by Mr. Connell,) than any other of an elementary nature. I think it right, for the sake of any one who may possibly be induced by this recommendation to purchase this work of Ritchie's, to say that, in the recent edition which has been published, the editor has not kept his word; for having promised the answers to *all* the questions in his preface, it is found that almost the whole, of any difficulty, are *left* unanswered.

A. H.

(*To be continued.*)

ON THE DETERMINATION OF TIME FROM ASTRONOMICAL TIME-KEEPERS. BY PROFESSOR POLE, F.R.A.S.

[The following articles were published in the *Bombay Courier* of May 2nd, May 6th, and May 27th, 1845. They are from the pen of Professor Pole, F.R.A.S., of Elphinstone College, Bombay, and were principally intended to interest the young native pupils of the college, and the many officers of the

Indian Navy stationed at Bombay, in the subject of astronomical time-keeping.
C. E. B.]

Bombay, 19th June, 1846.

Errors in Jest made Truth in Earnest.
(*2nd May.*)

The measuring of time is of consequence to everybody; throughout the wide world it would be difficult to find a single person who is not directly concerned in the rate of its flight, or who has not personal interest in marking the divisions of its course. But in a sea-port town, the resort of those who have to depend upon the accurate measurement of time for fortune—safety—life itself, it is natural that everything which has an influence, directly or indirectly, upon the correctness and facility of chronometrical determination, should be matter of the deepest interest.

Nothing in this world is perfect, therefore it is not to be expected that time-measuring instruments should form an exception to the general category. Even the sun himself, the great chronometer of nature, is constantly wrong except at four instants of the year; and with such an example (although we can beat the sun in correctness) how can we expect any works of our erring fingers to be free from error? The only thing which goes correctly is an IMAGINARY SUN, known to astronomers as the MEAN SUN, which is *supposed* to move uniformly through the heavens, and to occupy an exact constant interval, called a *mean day*, between any two successive passages of the same meridian. We can conceive the astonishment of an unlearned individual on entering an astronomical observatory. He has been accustomed to consider that the only criterion of a watch *going well*, is its generally keeping within a few minutes of the true time, and has universally thought his own pocket turnip a paragon of excellence because it seldom is five minutes *wrong*. Now, if taken to an observatory, and told that was a place where the true time was taken many times in a day—and where, perhaps, a number of the best time-keepers that could possibly be obtained were in constant use—how would he stare when, among the host of clocks and chronometers, he would probably fail to find one which was *anywhere near* "right," except the old wooden Dutch clock belonging to the cook-maid, and hung up in the kitchen to enable her to cook the Astronomer Royal's dinner by the time he ordered her! Errors therefore, he would easily be led to believe, will happen with best-regulated chronometers.

Now, to carry on the story, we will suppose honest John Bull to encounter the Astronomer Royal, who with a very bland face, after telling him how rejoiced he is to have the pleasure, &c., offers to escort him round the establishment. "Here," Mr. Airy will say, "is an equatorial telescope, which sweeps the whole heavens in any direction;—here is our mural circle, with which we take meridian altitudes of the heavenly bodies;—and here is the great transit, by which we find our time, and correct that excellent clock there, which you see standing close by." At this John's eyes sparkle; he thinks he has the astronomer in a corner; for (supposing the date of his vision to be about June) he sees with a glance that the clock is five or six hours too fast. But wishing to bear his faculties meekly, he modestly asks whether there is not some slight derangement at the present time? "Oh, no," will be the reply, "last night the error was only a few seconds; but" (after a short pause, Mr. Airy will continue) "I see you do not quite understand; that clock points to *sidereal* time, which is a different kind of time to that which probably you have been accustomed to, but which I cannot exactly explain to you now for fear of keeping you too long from the city; you will find all about it in my folio treatise, volume the eleventh, page 968." "Wish you may get me to bother myself with your treatise," thinks John, who, never having heard of *Tempus edax rerum* appearing in more than one shape, begins to speculate upon the possibility of the Astronomer Royal having looked at the moon until she had vouchsafed to impart some of her own nature to ———. "But," says the astronomer, interrupting, "here is a chronometer, lately received on trial from Mr. M'Cabe, which marks *mean time*, (that is the time you have been accustomed to,) and which is the best I have yet seen." "Oh, indeed," says John Bull, recovering from his reverie, and stealing a stray glance at his own pocket-piece; "but pray, sir, are you sure this one is a good chronometer? for I find the time by my watch (and I know I am right by St. Paul's) to be *five minutes past one*, and your chronometer marks *twenty-five minutes past*; therefore you must be twenty minutes too fast." "Very true," replies Mr. Airy, with a good-tempered smile; "what you say is quite right, but you see if *we know* that the chronometer is twenty minutes too fast, or, to speak in our own language, if we know the ERROR to be '*fast*, or *plus*, twenty minutes,' we can tell the exact time by it just as well as you can by your own watch or by the clock of St. Paul's;—perhaps better." Now, of course, John sees the reasonableness of this logic, and begins to think the astronomer not quite so mad as at first; so being willing to satisfy himself further, he remarks, "I

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think I understand you now, Mr. Airy; you mean to say that you have only to suppose the chronometer put *back* twenty minutes, or to *deduct* twenty minutes from the time it shows, to get the exact time." "Precisely so; and this other chronometer (which is also a very good one) you will perceive shows five minutes to one, therefore we have only to suppose it put *forward* ten minutes, or to *add* ten minutes to the time it shows, to get the true time."

"This is very clear, Mr. Astronomer; but when I find *my* watch too fast or too slow I just open the glass and shove the hands round till I make them right; now since you say that your watches are very good ones, and keep exact time, why do you not do the same? for if you once set them right, according to your own showing, they would *keep right*, and thus save you all your adding and subtracting."

"I beg your pardon, Mr. Bull," the astronomer would reply, "*you* are going too fast, like the watch itself, I said no such thing. I said, it is true, that the chronometers were very good ones, and so they are; but I did *not* say they kept exact time, for this they do *not* do. If I were to set this watch right now, in some days hence it would be several minutes wrong again, and thus all my trouble would be thrown away; and yet it goes excellently notwithstanding."

John thinks of the moon again, with redoubled earnestness, but makes no reply. The philosopher continues:

"I see this puzzles you, and very naturally; I have just time to explain it briefly to you before I go to look after the computers in the next room. We cannot get watches to keep exact time; that is out of the question, and is never attempted, all we look for is that their RATE, that is, the quantity they gain or lose each day, shall be even and regular. For example, this watch, the first I mentioned, is gaining one minute per day:* to-day it is, as you have seen, twenty minutes too fast; yesterday it was *nineteen* minutes too fast; to morrow it will be *twenty-one* minutes too fast; and in ten days hence it will be *thirty* minutes too fast. But it has this good quality, that *it always gains exactly the same amount every day*, and this is what constitutes a good chronometer. Similarly with the other; that is, *losing* half a minute per day; to-day it is *ten* minutes too slow; yesterday it was *nine and a half* minutes too slow; to-morrow it will be *ten and a half* minutes too slow; and in ten days hence it will be *fifteen* minutes too slow. But like the other, its rate is regular; it loses always *exactly the same amount every day*, and thus its good character is proved. I must now take leave of you, Mr. Bull. I hope you have been amused with the sight of the observatory, and as I always wish to combine the *utile* with the *dulce*, I trust you have learned the following facts in reference to astronomical time-keepers, which perhaps you, in common with many others, did not know before.

"1st. That the time shown by a chronometer is never expected to be the *true time*. The difference between them is called the *error* of the watch, and if this is known, the true time can at once be ascertained from that marked by the chronometer.

"2nd. That a chronometer is never expected to keep true time, it always either gains or loses. The quantity it gains or loses per day is called the *rate* of the chronometer.

"3rd. That the excellence of a watch consists in its *rate being uniform*, or in its gaining or losing exactly the same amount each day. I need scarcely tell a gentleman of your intelligence, that if this can be depended on, we need only know the *rate* of the watch and its *error at any given time*, to be able to deduce, whenever we please, the exact true time from that indicated by the hands of the chronometer.

"If you are inclined to enter further into the matter, you will find a sequel to this *C(l)ock* and *Bull* story in that excellent and ably conducted journal the *Bombay Courier* of the 6th of May, 1845; in the mean time, I wish you, sir, a very good morning."

On Chronometrical Errors. (6*th May*.)

In our last issue we endeavoured to explain the nature of the errors occurring in the indications of instruments for measuring time, and to show that those errors were of little consequence provided their nature was known, and their rate of progress could be depended upon. We have now a word or two to add upon the *nomenclature* of chronometrical errors. And it is obvious this is a matter of some importance; for since certain operations are to be performed, whenever it is wished to eliminate or get rid of those errors in determining time, the nature of those operations must be indicated by the nomenclature of the data we have to work upon, and this involves a clear idea of the distinctions between the various kinds and changes of discrepancy which may arise between the indications of a chronometer and the corresponding absolute true times.

Now, first, as to the *error* of a chronometer, which is, as we have already explained, the difference between the time shown by the watch and the true time. It

* Extreme cases, selected merely for illustration.

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is evident at a glance that this error may be in either of two directions; *i. e.*, the watch may be either *too fast* or *too slow*. How then should errors be denoted? The question almost answers itself. When the watch is too fast the error is obviously a *fast* error, and when too slow, it is obviously a *slow* error. This is too self evident to be gainsaid. Hence we will draw our first proposition.

Prop. I. "When a chronometer is said to have a *fast error*, it is understood that the time indicated by the chronometer is *fast* of true time. When it is said to have a *slow error*, the time indicated is *slow* of true time."

Thus, if on a given day a watch is found to be twenty minutes fast of mean time, we record, for that day,

Error, 0h. 20m. 0s., *fast*.

And if at any given time a watch is found to indicate fifteen minutes too slow, we denominate it

Error, 0h. 15m. 0s., *slow*.

It is obvious that fast and slow errors are in reality convertible; for example, if time is reckoned in a circle of 12 hours, 2 hours too fast is the same thing as 10 hours too slow; or if the clock marked the 24 hours, to correspond with the astronomical divisions of the day, 2 hours too fast would be the same as 22 hours too slow, and *vice versâ*. But it is usual to take the nearest, and make the error the smallest, of the two; and it only requires a little care when the error may chance to be near the value of 6 hours, to render this plan perfectly simple and easy, and to prevent all possibility of confusion.

Now, the *rate* of a chronometer is evidently a different thing from the error. The former influences the latter only as to its amount of *change*, and has no direct connection with its *absolute* value. It ought therefore to be distinguished carefully as to its nomenclature. We often hear of a *fast* or a *slow* rate, but this form of expression is injudicious, and leads to mistakes. To take a parallel case: the amount a merchant or tradesman gains or loses in a year is independent of the total value of his property, although it influences its change; and the amount of yearly profit and loss requires to be distinguished carefully in his books from his total amount of stock or aggregate property. So with the time. The *rate* of a watch corresponds with the profit or loss of the merchant, while the *error* may be represented by his total property, and both must be distinguished from each other. The most correct manner of distinguishing the rates of chronometers is at the same time the most natural, and is perfectly independent of the error. Every child knows what a clock's *gaining* or *losing* means, and these terms at once suggest themselves as the proper ones for appending to the rates.

Hence, *Prop.* II. "When a chronometer gains on true time, its daily rate is called a *gaining* rate: when it loses, the rate is called a *losing* rate."

Thus, if a watch gain one minute per day, we describe this as

Rate, 0h. 1m. 0s., *gaining*.

If it lose half a minute per day, we say

Rate, 0h. 0m. 30s., *losing*.

It is now easy to see the effect of the *rate* upon the amount of the *error*. If a watch is too *fast*, a gaining rate will evidently tend to make it faster still, but if too slow, it will bring it nearer to true time. Similarly, if the watch is already too slow, and loses every day, it will become every day further removed from the true time, or the error will increase, but if at first too fast, every day will bring it nearer true time. Thus,

Prop. III. "A *gaining* rate tends to *increase* a *fast* error, and to *diminish* a *slow* one. A *losing* rate tends to *increase* a *slow* error, and to *diminish* a *fast* one."

Now, to take a few examples of the application of these rules.

1st. Suppose we receive a chronometer from the maker, who gives us the following two lines accompanying it on a scrap of paper:

Error on the 1st May, 0h. 21m. 15s. fast,
Daily rate .... 0h. 0m. 10s. gaining,

required to find the true time from the chronometer on the 21st May.

Twenty days having elapsed since the date of the given *error*, we have first to multiply the daily rate, 10 seconds by 20, which gives us 200 seconds, or 3m. 20s. for the increase of error; so that adding this to the given error on the 1st May, makes a total of 24m. 35s. for the *error of the watch* on the 21st May, and if this amount is deducted from the time indicated by the chronometer, the result will be the true time; that is, of course, supposing that the rate has remained regular. Thus, if the watch shows 1h. 38m. 40s., the true time will be 1h. 14m. 5s.

2nd. Instead of the former rate, substitute

Daily rate 0h. 0m. 8s. *losing*.

Here the 20 days at 8 seconds per day gives 2m. 40s., but this has to be subtracted from the given error on the 1st May, according to our third proposition; and hence we have the error on the 20th equal to 18m. 35s., which has to be deducted from the indication of the watch as before.

3rd. Suppose the data are

Error on the 1st May, 0h. 4m. 7s. slow,
Daily rate .... 0h. 0m. 2s. losing,

required the correction for true time on the

21st May. Here, 20 multiplied by 2 seconds, gives 40 seconds. This, according to our third proposition, being a losing rate, *increases* the slow error, which becomes 4m. 47s. If, therefore, the watch shows 8h. 56m. 3s., the true time will be (*adding* the error to the indication) 9h. 0m. 50s.

4th. Substituting for the former rate

Daily rate 0h. 0m. 1s. *gaining*,

we have in 20 days the error *diminished* by 20 seconds, or equal to 3m. 47s., which has to be added to the indication as before.

When the time is required very accurately, of course *parts of a day* must be allowed for in calculating the alteration of the error, and this implies the knowledge of the hour of the day at which the given error was observed.

The distinguishing appellations above laid down are obvious and simple; so simple, indeed, that it would seem scarcely possible to mistake them, or introduce error into their use. There is, however, another system of nomenclature, adopted frequently by the highest authorities, and used perhaps more generally than the one we have described in this article. It has been our principal object to give consideration to this system, but we have unwillingly occupied so much space in our introductions that we must, in mercy to our readers, postpone chapter the third till another issue.

On Chronometrical Errors. (*May* 27.)

In treating of this subject some time ago, we endeavoured to explain the nature of the errors usually obtaining in the indications of chronometrical instruments, and the manner in which it appeared most natural to designate them. We mentioned that the *error* of a watch might be denominated either *fast* or *slow*, according as its indication was before or behind the true time;—and that the *rate* should be distinguished as *gaining* or *losing*, as the watch might tend to either of these discrepancies. We intimated, however, that there was another and a very general method of denoting the direction of these variations, which, as it was made use of by high authorities, ought to be thoroughly understood by all having occasion to use time-keepers for astronomical purposes.

This is by employing the algebraical *plus* and *minus* signs instead of the words which we have attached to the errors and rates. The proper use of the signs is not so simple as that of the words, and to this point we shall therefore direct attention in the present article.

First, as to the Error. There are two ways of describing this according to the former method, *fast* and *slow*. There are also two ways according to the plan at present under consideration; *plus* (+) and *minus* (−). How then should these correspond with each other? Which sign should be used for a *fast* error, and which for a *slow* one?

Let us consider what the "error" means. It is the result of a comparison of one quantity with another: *i. e.* a comparison of the incorrect time shown by the hands of the watch with the *true* time. The difference between these is the "error." Now suppose we were comparing any other erroneous quantity with the quantity it ought to amount to; for example, if we attempted to cut a piece of wood a foot long, or to pour a gallon of water into a tub;—and on comparing these with a foot rule and a gallon measure respectively, were to find the stick to be an inch *too long*, or the water to be half a pint *more* than a gallon; *i. e.* both *greater* than the *true* amount, how should we designate these discrepancies? There could not be a question. We should of course say they were in excess; were *more* than they ought to be; were, in a word, Plus the true quantity. To call the errors in such case *minus*, would be in effect to make the erroneous quantities the standards, and to compare the *true* quantities with *them*, which would be contrary to common sense.

To apply this reasoning, then, to our present case. We have an *erroneous* quantity,—the number of hours, minutes, and seconds shown by the incorrect watch,—to be compared with a *correct* quantity,—the hours, minutes, and seconds of the true mean time. If then the former is *greater*, *more*, than the latter, it is evidently *plus* the true quantity, and the *error* must be designated as a *plus error*. And *vice versâ* when the watch is *slow* of true time, the error is a *minus error*. To call them otherwise, would be making the *watch* the standard, and the true time the quantity compared, which is contrary to the hypothesis. Hence

Prop. IV.—"A *fast error* is designated by the *plus* sign (+). A *slow error* by the *minus* sign (−)."

Thus (to take the examples appended to our previous propositions), if on a given day a watch is found to be twenty minutes fast of mean time, we record, for that day,

Error, + 0h. 20m. 0s.

And if at any given time a watch is found to indicate fifteen minutes too slow, we denominate it

Error, − 0h. 15m. 0s.

The argument used in behalf of the contrary practice to that we have above enunciated, is as follows:—"In order" (say our opponents) "to find *true* time from that

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indicated, supposing the watch to be fast, we have to *deduct* the amount of the error; and hence a fast error should be denominated a *minus* quantity." But we may instantly turn this argument in our own favour by supposing that instead of it being required to find the *true* time from the *watch*, we want to find the *watch* time for a given *true* time, which is a case of constant occurrence, as when looking out for transits, eclipses, or any phenomena occurring at definite times. Here we should have to *add* the amount of the *fast* error; and therefore the argument, cutting both ways, is worthless and inapplicable.

But the argument itself is founded on an erroneous confusion of the *error* with the *correction* of the error, which are two distinct things. One is a simple statement of a fact already existing, the other a description of a process proposed to be performed. It would not follow that because we found our piece of stick was an inch too long, we must straightway set to work and cut the superfluous part off with our penknife, or that our extra half pint of water must forthwith be ladled out of our tub. These corrective processes are subsequent to, and not identical with, or necessarily consequent upon, the simple determination and expression of the value of the errors; and, therefore, all questions relative to the latter ought to be decided without the introduction of the former into the consideration.

Secondly, as to the *rate* of a chronometer.

We have in a previous article objected to the use of the same terms for the rate as are used to designate the error: but here, since we have only two signs at our disposal, we must use them for both objects—and therefore our guide must be to make the two uses as nearly synonymous as possible. Since, then, a *gaining* rate tends to produce a *fast* error, and a *losing* rate a *slow* one, we apply the signs in a corresponding manner, *i. e.*,

Prop. V.—"A *gaining* rate is designated by the *plus* sign (+); a *losing* rate by the *minus* sign (−)."

Thus, if a watch gain one minute per day, we describe this as,

Rate, + 0h. 1m. 0s.

If it lose half a minute per day, we say,

Rate, − 0h. 0m. 30s.

It is easily seen that the effect of the rate upon the error, expressed by the signs, follows the laws of ordinary addition in algebra. For referring to the third proposition in our former article, a gaining (+) rate tends to increase a fast (+) error, and to diminish a slow (−) one. A losing (−) rate tends to increase a slow (−) error, and to diminish a fast (+) one. This corresponds to one of the first and simplest rules taught to a beginner in algebraical notation.

We have thus shown what rules should be adopted in following out the system of nomenclature we have had under consideration in this article, and have given the reasons upon which these rules are founded. We have now only to add that these rules are followed by the Greenwich observatory, and we believe by most, if not all others of eminence; and that this circumstance furnishes a grand argument, if no others existed, why they should be universally adopted, in order that uniformity may obtain in such an important scientific matter throughout the world.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 309.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

Richard Ellis, of George-street, Foster-lane, London, goldsmith: for a new mode of plating steel or iron with gold or silver. Cl. R., 19 Geo. 3, p. 3, No. 17. Jan. 30, 19 Geo. 3; May 28, 19 Geo. 3, 1779.

Isaac Narbell, of Chelsea, gent.: for a certain bitumen or fire mastic, which will be found an expeditious, durable and efficacious covering or sheathing for ships at war, and all other ships and shipping in all seasons and climates, as from the hardness, texture, and bending qualities thereof no worm or other insect can ever pervade the joints or planks, or other parts of any ships covered therewith, and from the smoothness and polish which the said bitumen naturally forms, defeats the adhesion of any weeds, &c. &c. Also for another composition called The Egyptian Mastic, which, being reduced from stone into a state of pliability for the trowel, may be laid on all timber buildings, the walls, and other component parts of houses, and in a few hours after will acquire such a degree of hardness and strength of consistence, as to be not only impervious to water, and all damps or moisture, but will effectually preserve all buildings from fire, &c. The said Egyptian mastic may also be cast into moulds of different forms, and of any magnitude, for buildings, and every species of ornament; and although it will receive and retain the purest and clearest impressions whilst in a state of dissolution, it will, in a few hours afterwards recover its pristine

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hardness and durability, and form a beautiful and lasting stone, with a whiteness and polish equal to marble, without baking, or any other operation of fire whatsoever. Cl. R., 19 Geo. 3, p. 4, No. 12. May 26, 19 Geo. 3; August 4, 19 Geo. 3, 1779.

Gabriel Wright, of Fleet-street, London, mathematical instrument maker: of a new constructed azimuth, and amplitude compass and quadrant, for the improvement of navigation and practical astronomy. Cl. R., 19 Geo. 3, p. 4, No. 7. June 25, 19 Geo. 3; Sept. 25, 1779.

John Dietrick Müller, of St. James, Westminster, gent.: of a machine or engine, constructed on self-moving principles. Cl. R., 19 Geo. 3, p. 4, No. 4. June 16, 19 Geo. 3; Oct. 15, 1779.

Samuel Eaton, of Nottingham, hosier: of a machine for knitting without the use of jacks or sinkers. Cl. R., 19 Geo. 3, p. 25, No. 3. July 29, 19 Geo. 3; Nov. 22, 1779.

John Johnson, of Berner's-street, Mary-le-bone, architect: of a particular manner of securing buildings from damage by fire [by laying down thin tiles or slates upon the rafters.] Cl. R., 20 Geo. 3, p. 1, No. 12. Oct. 15, 19 Geo. 3; Feb. 1, 1780, 20 Geo. 3.

John Campion, of Newcastle-court, Saint Clement Danes, (Middlesex,) locksmith: of an alteration in the formation and construction of all kinds of locks and latches, so that they cannot be picked or opened but with a key which is made for the same, and so as no dirt, dust, or other matter can enter through the key-hole of such locks and latches, which may damage the same. Cl. R., 20 Geo. 3, p. 2, No. 2. March 4, 20 Geo. 3; July 1, 1780.

William Somerton, of Bath, carrier: of new invented friction boxes, for all sorts of wheel and other carriages, for ship-work, house-work, mill-work, and engines and machines of every kind. Cl. R., 20 Geo. 3, p. 4, No. 15. June 14, last; Oct. 12, 20 Geo. 3, 1780.

John Mitchell, of Oakley, of Wooten, (Hants,) gentleman: of a new invented method of rectifying spent lees from which soap has been made, and rendering the same of a quality to make soap again. Cl. R., 20 Geo. 3, p. 8, No. 13. March 30, last; July 25, 1780.

John Champion, senior, of Bristol, merchant: of a new method for making brass and spelter. Cl. R., 20 Geo. 3, p. 12, No. 7. Nov. 24, 20 Geo. 3; Feb. 26, 1780.

Edmund Greaves, of Sheffield, silversmith: of a screw nosle for candlesticks of silver, or any other metal, of an entire new construction. Cl. R., 20 Geo. 3, p. 12, No. 2. Dec. 17, 20 Geo. 3; Feb. 26, 20 Geo. 3, 1780.

Mathew Sanderson, of Masborough, (York,) chemist and refiner: of a new process for extracting from lead, glitter, or bluestone, and iron ores, alum, sulphur, white and green vitriols, and from copper ores, blue vitriols; refining and separating their metallic contents by a blast furnace, and rendering their refuse useful in painting and other purposes. Cl. R., 20 Geo. 3, p. 14, No. 14. Feb. 5, 20 Geo. 3; May 9, 20 Geo. 3, 1780.

James Keir, of Birmingham, gentleman: of an invention of a compound metal capable of being forged when red hot, or when cold more fit for the making of bolts, nails, and sheathing for ships, than any metals heretofore used or applied for those purposes, and also for various other purposes where other metals have been used or applied. Cl. R., 20 Geo. 3, p. 19, No. 10. Dec. 10, 20 Geo. 3; April 10, 1780.

William Bell, of Birmingham: of a more speedy method of affixing impressions from dies upon gold, silver, or metals, by means of rolling cylinders on which such dies are engraved, which will be to the great benefit of trade, particularly to the buckle, button, and toy manufactories. Cl. R., 20 Geo. 3, p. 19, No. 6. Dec. 26, 20 Geo. 3; April 25, 1780, 20 Geo. 3,

James Watt, of Birmingham, engineer: of a new method of copying letters and other writings expeditiously. A parchment schedule, consisting of two pieces of parchment stitched together, is attached, being a draught and description of the press to be used in the said process. Cl. R., 20 Geo. 3, p. 20, No. 18. Feb. 14, 20 Geo. 3; May 22, 1780.

Thomas Lindopp, of Birmingham, brass-founder and factor: of a saddle upon a new construction, called the Scoop Saddle, [with a cavity therein so as to contain and carry some necessary wearing apparel.] Cl. R., 20 Geo. 3, p. 22, No. 17. May 4, 20 Geo. 3; Aug. 15, 20 Geo. 3, 1780.

George Beck, of Plymouth-dock, gentleman: of an invention of a complete apparatus for surveying and planning in general by land and sea, which is more easy and expeditious in use than any other already invented, and equally accurate with any instrument or apparatus heretofore made for the purposes of planning and surveying. Cl. R., 21 Geo. 3, p. 2, No. 16. Dec. 16, 21 Geo. 3; April 13, 1781.

John Graefer, of Mile End, in the parish of St. Dunstan, botanic gardener: of an invention of the art of drying and preparing a vegetable of the brassica kind, generally known by the name of green and brown borecole, Scotch, or other kale, so as to keep a twelvemonth or longer, without

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losing any of its real natural flavour, and make it an excellent food, and its virtue a great preventive of scorbutic disorders, which will be of great public utility, particularly to His Majesty's Navy. Cl. R., 21 Geo. 3, p. 2, No. 14. Dec. 30, 21 Geo. 3, April 28, 1781.

William Squire, of Wardour-street, in the parish of St. James, (Middlesex,) instrument and tool-maker: of an invention of a new constructed spring truss, for the relief of persons afflicted with ruptures. [Single and double trusses.] Cl. R., 21 Geo. 3, p. 3. No. 11. April 23, 21 Geo. 4; June 28, 1781.

Archibald, Earl of Dundonald: of a method of extracting or making tar, pitch, essential oils, volatile alkali, mineral acids, salts, and cinders from pit coal. Cl. R., 21 Geo. 3, p. 4, No. 7. April 30, 21 Geo. 3; Aug. 8, 1781.

James Sharp, of Leadenhall-street, ironmonger: of a new invented curious stove or grate, answering every purpose of the American, German, or register stoves, but in its effect superior to any of them for the warming of rooms, churches, or halls, with power of increasing or diminishing the heat thereof, and without consuming so much fuel as other stoves heretofore discovered. Cl. R., 21 Geo. 3, p. 5, No. 8. Aug. 21, last; Oct. 18, 1781.

(*To be continued.*)

LIST OF ENGLISH PATENTS GRANTED FROM MARCH 27, TO MARCH 31, 1847.

Charles May, of Ipswich, Suffolk, civil engineer, for improvements in railway chairs, the fastenings to be used therewith, and in trenails. March 27; six months.

John Henry Grieebach, of Carlton Villas, Maida Vale, for improvements in the construction of railways, and in engines and carriages to run thereon. March 29; six months.

Alexander Morton, of Morton-place, Kilmarnock, for improvements in printing warps. March 29; six months.

John Fisher, the younger, of Radford Works, Nottingham, mechanician, for improvements in the manufacture of lace or weavings. March 29; six months.

Samuel Hardacre, of Manchester, machinist, for certain improvements in machinery or apparatus for opening and for carding cotton and other fibrous substances, and for grinding the cards of carding engines. (Being partly a communication.) March 29; six months.

George Robert Skene, of Bedford, Esq., for improvements in making and refining infusions and decoctions. March 31; six months.

Henry Woodfall, of Foots Cray, Kent, paper-maker, for certain improvements in paper-making machinery. March 29.

Samuel Millbourn, of St. Mary's Cray, Kent, paper-maker, for improvements in the manufacture of paper. March 29.

The two last patents being opposed at the Great Seal, were not sealed till March 29, but are dated the 3rd October, 1846, by order of the Lord Chancellor.

Robert Jones, of Wardour-street, Soho, hot-presser and finisher, for certain improvements in dressing or finishing goods or fabrics. March 31; six months.

Advertisements.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

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E. GRANVILLE, Manager.

London, March 3, 1847.

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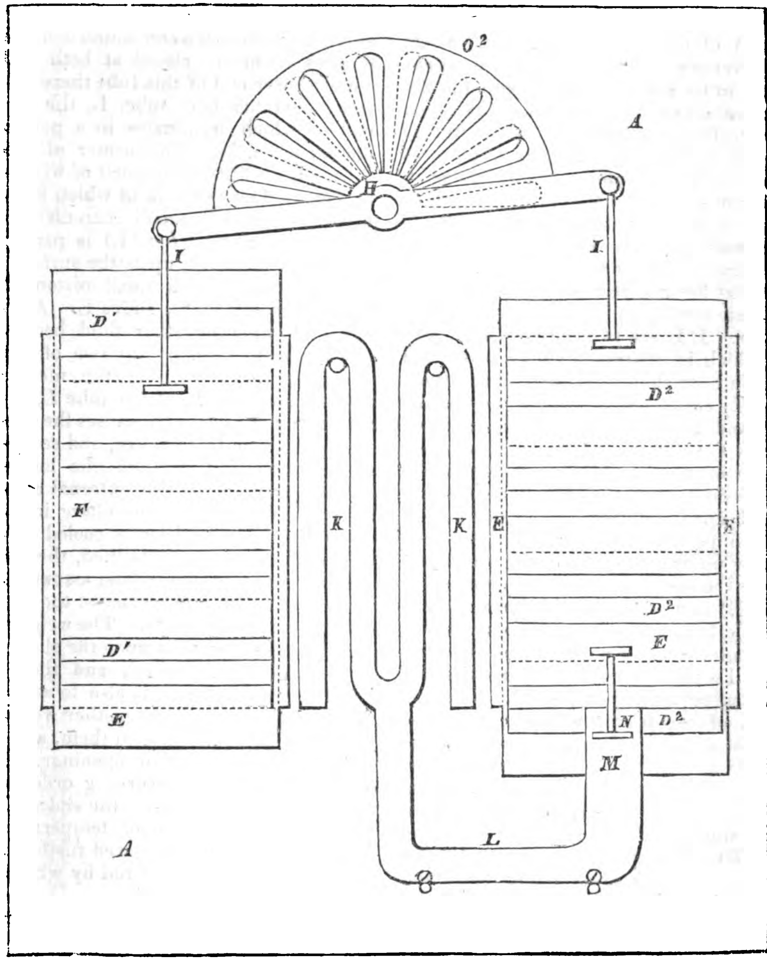
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1235.] SATURDAY, APRIL 10. [Price 3d.

Edited by J. C. Robertson, 166, Fleet-street.

WROUGHTON'S PATENT VENTILATING APPARATUS.

Fig. 1.



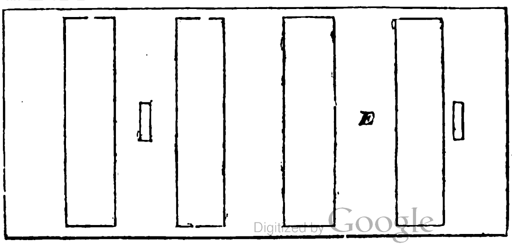


Fig. 3.

WROUGHTON'S PATENT VENTILATING APPARATUS AND IMPROVED RESPIRATOR.

[Patent dated August 26, 1846; Specification enrolled February 26, 1847.]

Mr. Wroughton's *apparatus for ventilation* is applicable generally to all enclosed places which it is desirable to keep at any given degree of temperature, but more particularly to public buildings, factories, granaries, and conservatories. Fig. 1 of the accompanying engravings represents a front elevation of this apparatus in its complete state, and fig. 2 a vertical elevation in section of the same, as attached to an aperture in the wall of a public building. A A is a plate of metal, glass, or other suitable material, (shown separately in fig. 3,) which is securely fixed over the aperture, B, in the wall. D^1 D^1, D^2 D^2 are two sets of parallel slots or louvres, which are cut out horizontally in the plate A A, and are exactly opposite the one to the other. E E are two sliding plates, (one of which is separately shown in fig. 3,) which have slots or louvres cut in them exactly corresponding with those marked D^1 and D^2 in the plate A, and shut or open the latter, wholly or partially, according as the plates (E E) are raised or lowered. F F are small fillets of metal fixed upon the face of the plate A A, which permit the plates E E to slide freely up or down, but at the same time keep the surfaces of the two plates (A and E) in a state of rubbing contact with each other. G is a small beam, which is centered upon a pin, H, in the plate A. From this beam the two slides E E are suspended by rods, I I. The two ends of the beam, with the rods and slides attached thereto, are made as nearly as possible to balance each other. O O is a semicircle of louvres cut out in the top of the plate A, which are opened and shut, wholly or partially, by means of a semicircular sliding plate O^2, having louvres in it corresponding with the others, and attached to the beam G, by the rising and falling of which it is turned round to one side or the other. When the beam G lays in a horizontal direction, then the whole of the louvres in the plate A (D^1 D^2 and O) are covered by the entire parts of the slides E E and O^2, and all communication with the external atmosphere through these orifices is stopped; but when the beam G is inclined either to the one side or the other, the louvres in all the three series of plates, D^1, D^2, and O, simultaneously open, either for the ingress of fresh air into the apartment, or for the egress of overheated or vitiated air.

The means by which this arrangement of slides and louvres is acted upon by an increase or decrease of temperature in the building or apartment are as follows:—K K is a compound bent tube of glass or metal, closed at both ends. To the lower end of this tube there is attached another bent tube, L, the open end of which terminates in a perpendicular piece, M. The former of those tubes (K) is filled with spirit of wine, or any other fluid the bulk of which is materially affected by small increments of temperature; the latter (L) is partially filled with mercury, upon the surface of which there floats a small piston, N, attached to one of the slides E. As the spirit of wine or other fluid becomes augmented in bulk by any rise of temperature, the surface of the mercury rises in the limb M of the tube L, and, forcing up the piston N, causes the slides E E and beam G to move, and so open a communication through the louvres D^1, D^2, and O with the external atmosphere. When the atmosphere in the room has been sufficiently cooled down by the fresh air thus admitted, then the spirit of wine or other fluid assumes its former bulk, and the surface of the mercury falls in the tube M. The weight of the piston N then falls upon the slide E, to which it is attached, and thereby causes it and the beam G also to assume their original position, together with all the other parts attached to them, and so close up the louvres or openings. To set the apparatus in working order, so that it may open or close the slides E E at any definite degree of temperature, the piston N may be screwed further up or down upon the small rod by which it is attached to the slide E.

Fig. 5 is a front elevation of this improved ventilator, as applied to a window, and fig. 6 a vertical section of fig. 5. The arrangements are in every respect, in so far as regards the ventilator, the same as those represented in figs. 1 to 4 inclusive.

The *respirator* of Mr. Wroughton is an immense improvement on that of Mr. Jeffery's, with which all the world is familiar. It has more than all the advantages of that instrument without any of its unsightliness. Fig. 7 is a side

Fig. 5.

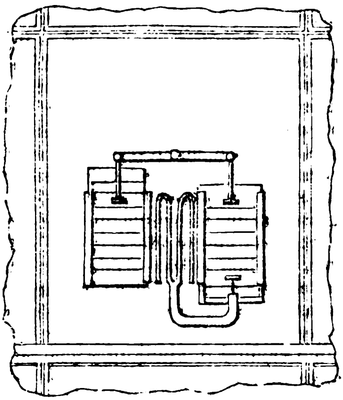


Fig. 6.

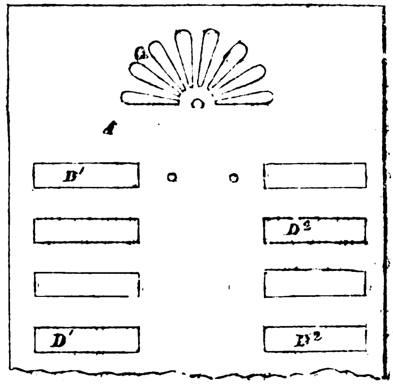


Fig. 7.

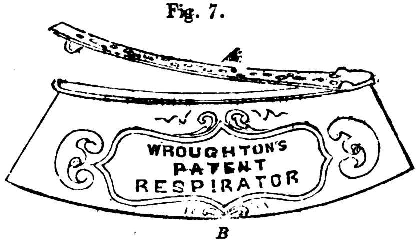
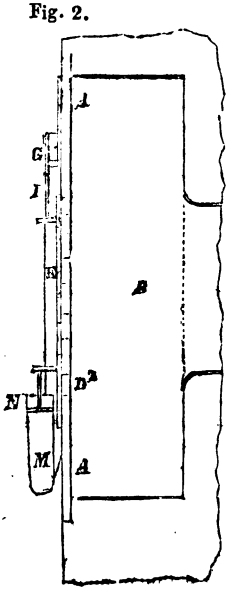


Fig. 2.



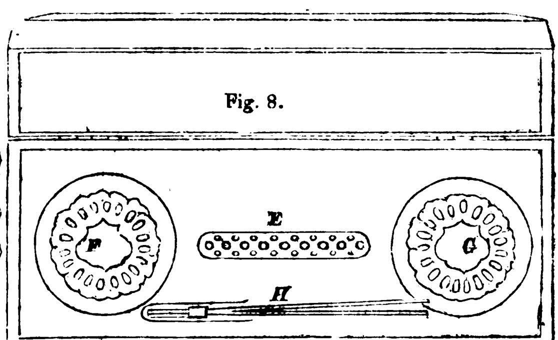


Fig. 8.

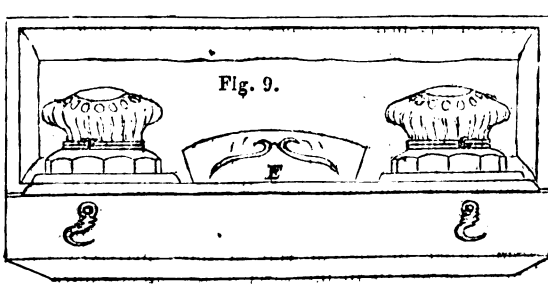


Fig. 9.

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view of the instrument. and figs. 8 and 9 views on a larger scale of the interior. The object of the instrument is to interpose, between the organs of respiration and the external atmosphere, an ante-chamber where the air to be inspired may be previously warmed, and where also it may be intermixed, if desired, with any medicinal vapour or odour. It consists of a flat rectangular case, perforated on its inner and outer faces, A and B, (or, in other words, at top and bottom,) with numerous small holes, and curved to fit the space between the lips and gums, so that it may be held there by the mere compression of the lips, and be externally invisible, or nearly so, when in use. The inner face, or top of the case (A), turns on a hinge, so as to admit of ready access to the interior. When the object is merely to elevate the temperature of the air inspired, the case is filled with one, two, or more layers of sponge. The air being inhaled through these layers becomes warmed, and the warmth produced is in proportion to the thickness of sponge which the air has to traverse. When it is desired to medicate the inhaled air, the medicating substance employed is placed between two or more layers of sponge. The pieces of sponge are to be taken out and renewed, or washed, dried, and replaced, as occasion may require, and the medicating substance must also be renewed from time to time. The instrument is manufactured of metal, and the patentee prefers making it of silver, as being less liable than most other metals to be affected by the saliva or other matters to which it is exposed. It may be worn in the pocket, or packed up in a small box containing a supply of sponge and other appliances, as represented in figs. 13 and 14, in which E represents the respirator, F a bottle containing sponge, G another bottle, for holding the medicated substance intended to be used; and H a pair of tongs with a brush for empting and cleansing out the instrument.

LONDON FIRES IN 1846.—BY MR. W. BADDELEY, C.E., INVENTOR OF THE PORTABLE CANVAS CISTERNS, IMPROVED ENGINE LAMPS, HOSE-REEL, PREVENTER, FIRE-ENGINE SPREADER, ETC., ETC.

"Hark! What was that? Hark, hark to the shout—
Fire! fire! then a tramp, then a rout,
And an uproar of voices arose in the air,
And the mother knelt down, and the half-utter'd prayer
That she offered to GOD, in her agony wild,
Was, 'Father, have mercy, look down on my child.'"—*Song.*

"The statistics of London fires are by no means devoid of interest, and the time may come when they will form an index to the social advancement of the people; for in proportion as houses are built more and more fireproof, and habits of carefulness become more and more diffused, the number of destructive fires will assuredly lessen."—*Knight's London.*

In presenting my *seventeenth* annual report of London fires, it is with unfeigned pleasure I remark that, although an increase of numbers marks those of the past year, the damage by fire (in the Metropolis) is the smallest within the memory of man.

We are not yet in a position to boast much of the fire-proof character of our houses—and habits of carefulness are still but sparingly diffused. Watchfulness to detect the outbreak of fire, and great promptness in the application of remedial measures, have, however, kept the "Fire-king" in most profound subjection, so far as the Metropolitan dominion is concerned. Of the eight hundred and thirty-four fires which occurred in 1846, two hundred and thirty-four were extinguished by the *inmates* themselves; three hundred and thirty were extinguished by the *inmates with casual assistance*: while the extinction of two hundred and seventy devolved upon the *firemen*.

The number of fatal fires, and the consequent loss of life, is still large; the character of these calamities, however, is greatly mitigated, the greater number of these accidents being of a personal nature; the soul-harrowing narratives of former years have been averted in a very great degree by the well-organised system of fire-escapes, which now extend over a very large portion of the Metropolis, and, if the public will, may soon cover the whole.

One thousand and twenty-two alarms of fire have been given at the fire stations during the past year, the particulars of which are set forth in the following table:

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Months.	Number of Fires.	Number of Fatal Fires.	Number of Lives Lost.	Chimneys on Fire.	False Alarms.
January	57	3	8	9	5
February	60	1	1	4	12
March	74	3	5	7	9
April	58	1	1	11	7
May	73	1	1	4	10
June..	77	0	0	2	7
July	78	2	2	3	12
August	71	0	0	5	11
September	70	1	1	4	14
October	62	2	3	5	8
November.....	71	4	4	5	13
December	83	3	3	10	11
Total	834	21	29	69	119

Of these fires there have been totally destroyed	20
Seriously damaged..	238
Slightly damaged	576
	834
Alarms from chimneys on fire....................................	69
False alarms	119
Making the total number of calls	1022
The number of cases in which insurances were known to have been effected on the building and contents, was	302
On the building only..	137
On the contents only..	125
No insurance..	270
	834

These particulars of insurance refer exclusively to the property in which the fire occurred, no notice being here taken of damages to adjacent premises.

Of last year's fires, I have considered the following worthy of notice:

Saturday, Jan. 3, 1½ A.M. A fire broke out at No. 23, Cambridge-place, Paddington, inhabited by Mrs. Prior, a laundress, and numerous lodgers. The fire, when discovered, was burning furiously in the first floor front room, and the inmates were roused with great difficulty; the fire having rapidly communicated to the staircase, the whole building was soon in flames. Conductor Parker, with one of the Royal Society's fire-escapes, was soon in attendance, but he was assured that all the inmates had effected their escape without its aid, and the flames prevented his making any search. The Parish, Brigade, and West of England engines arrived in rapid succession, and succeeded in a very short time in extinguishing the fire. As soon as this was accomplished, the firemen entered the ruins, and, to their great astonishment, observed the blackened remains of two human beings. Upon making an inquiry, it now turned out that a man and his wife, (Mr. and Mrs. Wain,) who occupied the second floor back room, had not been heard of since the fire, and no doubt was entertained that the bodies found were theirs, although, from their mutilated state, it was almost impossible to recognise them. The origin of the fire could not be satisfactorily ascertained.

Sunday, Jan. 11, 3¼ A.M. A fire broke out at the back of the "Castle" public-house, Strand, in the occupation of Mr. Parker. The Brigade, West of England, and County engines were soon in attendance, but for twenty minutes no water could be obtained. The firemen, in the mean time, had entered the premises to reconnoitre, and had just left them to carry out the plan of attack decided upon, when the "Castle," and No. 7 (the adjoining house,) both fell into the court with an awful crash. Most providentially no person was injured; had this accident occurred a few minutes either sooner or later, great loss of life must have ensued. The want of water alone saved the firemen. Eleven poor families lost their all by this calamity, but were most kindly relieved by a subscription set on foot by the Rev. F. S. Ramsay, the curate of St. Martin's. A sum of nearly £90 was collected, which was judiciously laid out in replacing for the suffering families those articles of necessary domestic use which they had lost.

Friday, Jan. 30, 2 P.M. An explosion of a fearful character, attended with the loss of five lives, took place at the premises of Mr. Kenyon, 14, King-street, Lambeth-walk, where his son carried on the manufacture of fireworks. At the time stated, there were in the workshop Mr. Kenyon, jun., and two young men, named Smith and Holmes, when, all at once, a quantity of fireworks exploded, filling the upper part of the house with sulphurous vapour. On hearing the alarm, the neighbours rushed to the spot, when the first thing they saw was a female endeavouring to escape from the house; she was assisted out and conveyed to Lambeth workhouse in a frightful state. John Smith and John Spier

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next emerged, their wearing apparel burning furiously, which was extinguished, and they were conveyed to St. Thomas's Hospital. Police-constable L 69 having entered the basement floor, there found the bodies of Kenyon and Holmes, quite dead and in flames. A poor child, named Alfred Ainger, aged two years, nephew to Mr. Kenyon, was standing in the back-yard at the time of the explosion, when the flames rushed through the window and burned him severely. He was taken to Guy's Hospital, where he died in great agony on Wednesday morning, making the *fifth* victim to this dreadful accident. On examining the premises after the accident, it was evident that this dangerous manufacture had been carried on, to say the least, in a very careless manner.

Sunday, March 15, $4\frac{1}{4}$ A.M. As city police-constable 586 was going his rounds, he saw smoke issuing from the shop of Mr. Plant, hosier and outfitter, No. 6, Gracechurch-street. Having raised an alarm, and despatched messengers for assistance, he knocked and rang several minutes before he could arouse the inmates, when the shopman (W. Jordan) answered from the second floor window, saying, "Very well, very well;" to which the constable replied, "It is not very well; the shop is on fire, and you must come down." By the prompt attendance of the firemen, the fire was soon extinguished, and, on entering the shop, it was apparent that a most diabolical attempt had been made to destroy the premises. The ends of the paper-parcels had been torn open, the shelves and walls daubed with pitch, and the shop fired in several different places. Insurances to a large amount had been effected upon the property.

Mr. Payne, the coroner, subsequently held a court of inquiry as to the origin of the fire, which lasted two days, and ended in a verdict that the premises had been "Wilfully set on fire by some person or persons unknown." Little *moral* doubt existed as to the perpetrator, but no *legal* proof could be obtained; the farce of offering a *reward* for his detection was gone through, but of course without avail. The fright occasioned by the outbreak of this fire caused the death of a much-respected female neighbour, making the crime a compound of *arson* and *murder*. The jury also passed a resolution, expressive of their approval of the prompt and energetic conduct of police-constable Ledeham at this fire, and Mr. Deputy Stevens, the foreman, presented him with a small sum of money, subscribed by the jury for that purpose. The following resolution met with the cordial response of the jury: "That the best and sincerest thanks are due from, and are hereby given by, this jury to William Payne, Esq., coroner for the city of London, for the lengthened, patient, and complete investigation, as to the cause of the fire at No. 6, Gracechurch-street, on Sunday morning last; and they further desire to express their great satisfaction at the revival, by that gentleman, of the ancient practice of holding courts of inquiry on all such fearful occasions in the city of London, which, we doubt not, will be productive of most important results." Mr. Payne returned thanks in a few words, and so this mysterious business terminated.

Sunday, March 22, 12 P.M. A most disastrous fire, attended with loss of life and other casualties, broke out in the shop of Mr. Timpson, surgeon, 77, Crawford-street, Paddington. The first-floor was occupied by the landlord, Mr. Hosking, his wife, and daughter, while the second floor was let to Mr. Butters—his family consisting of a wife and three children. At the time stated, Sergeant Bennett, 18 D, observed smoke issuing from the shutters; on giving an alarm, the young man who had charge of the shop, and slept in the back parlour, opened the private door. On hearing the shop was on fire, he ran up stairs to alarm the inmates, which having done, he escaped by the balcony of the first-floor window to the next house, as did also Mr. Hosking and family. The policeman despatched the first messengers for the *engines* and the *turncock;* subsequently he sent for the *fire-escape.* During the interval which elapsed, the inflammable contents of the shop caused the flames to spread with extraordinary rapidity, and great anxiety was felt for the inmates of the second floor, who, on being aroused to a sense of their danger, found the staircase in flames, and escape in that direction completely cut off. Mrs. Butters, frantic with fear, rushed to the front window, and precipitated herself into the street before any person was aware of her intention.

Mr. Butters next appeared at the window, when Conductor Parker, with the Royal Society's fire-escape, arrived, and the machine was hastily placed against the burning building. The conductor instantly ascended, and, grasping Mr. Butters, attempted to get him out of the window, when he broke from his hold, and proceeded to the back room to save his children. At the same moment the shop-front was blown out with a loud explosion, and the flames from the shop and first-floor windows enveloped the fire-escape, causing the conductor to lose his hold, when he fell heavily to the ground, and was taken up much hurt. The engines being got into operation, the fire was soon extinguished and the premises entered, when the body of Mr. Butters was found just within the window at which he was last seen. His three children, Robert, aged $7\frac{1}{2}$; Jane, aged 4; and William, aged $1\frac{1}{2}$ years, were all found suffocated by the smoke in the back room; breathing had scarcely ceased when they were got out.

This awful catastrophe is solely attributed to the police-constable sending for the *fire-escape* LAST. Had the *first* messenger been despatched for *that*, instead of the engines, these unfortunate sufferers would, in all probability, have been rescued, and Mrs. Butters and the fire-escape conductor saved from their serious injuries. The coroner's inquest in this case returned a verdict—"That the four deceased persons lost their lives at the fire at 77, Crawford-street; but how the said fire occurred there was not sufficient evidence to prove."

Wednesday, April 1, 3 A.M. A terrific fire broke out upon the extensive premises known as the Canada Steam Saw Mills, in Rotherhithe-street, belonging to Messrs. Vertue and Co. The fire had attained a considerable head before it was discovered, and from the highly combustible nature of the building and its contents, the flames raged with great vehemence. The Brigade engine, from Rotherhithe, and the West of England, were the first to reach the fire, and were soon in full operation. The floating engine was manned, and got alongside as quickly as possible; but, in spite of every exertion, the fire continued its progress until the saw mills and their contents were consumed.

I was called up by a policeman soon after three o'clock, with intelligence that a large fire was visible in the direction of Whitechapel; on arriving there, I was directed onward to Old Gravel-lane, Wapping, whither I was proceeding when, on reaching Shadwell High-street, I met the engines retracing their steps, the fire having been ascertained to be on the

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opposite side of the river. Taking hold of the first engine, I was running to get up my speed preparatory to jumping up, when my leg suddenly snapped in two; other engines following close behind at full speed, I threw myself across the road, and rolled on to the pavement out of the way. On hearing my cries for help, Mr. Foggo, (the district foreman,) who was on the last engine, pulled up, and having ascertained the nature of my accident, he placed me in a cab, and conveyed me to Guy's Hospital. There I was received by Mr. Hicks, the house surgeon, who found I had sustained a very oblique racture of the left leg, and treated me accordingly. The news of my misfortune (of which a most incorrect account appeared in the papers) soon spread, and excited much sympathy. In the course of the morning, the inquirers at the hospital were very numerous; among the first were Mr. Braidwood, Mr. Connorton, Mr. Robertson, editor of the *Mechanics' Magazine*, Lord Thurlow, and others. While in the hospital I received the most polite and kind attention from all the persons connected with that excellent institution. To Mr. Buckell, my dresser, I am deeply indebted; to his constant watchfulness and skilful attention I mainly attribute my speedy and perfect restoration to the powers of pedomotion.

Friday, July 3, 1½ A.M. As police-constable Smith, 27 R, was going his rounds, he discovered smoke issuing from the shop of Mr. J. G. Moorse, oil and colourman, Trafalgar-road, Greenwich. On raising a cry of fire, Mr. Moorse came running up and unlocked the door. On entering the shop, Smith saw a few glimmering lights at the end of the counter, which he thought he could easily extinguish, but Moorse prevented him by saying, "There are fourteen pounds of gunpowder in a bag close by." Smith then withdrew, and closed the shop door to keep the people away. Engines from the parish and Greenwich Hospital were soon in attendance, but for upwards of half an hour no water flowed from the Kent mains, during which time the building, a small one, was burnt down. The West of England and Brigade engines, from town, subsequently reached the spot and saved the adjoining buildings. Two very slight explosions of gunpowder took place during the fire.

The circumstances attending the fire being so suspicious, Mr. Carttar, the coroner, held a court of inquiry, when the foregoing facts were given in evidence. It was also proved that all the gunpowder on the premises did not exceed half a pound, and that was in two parcels not confined.

The jury returned the following verdict:—"That the fire was originated by 'design,' and from the 'wilful act' of some person or persons, but how, or by whom, there is no sufficient evidence to prove; and that at the time of the first discovery of the fire it might easily have been extinguished, had it not been for the report of gunpowder being on the premises, which does not turn out to be the case." This affair created a great sensation in the neighbourhood, but no further proceedings followed.

Sunday, July 19, 3½ A.M. A fire broke out in the lower part of the Commercial Coffee House, No. 76, Newgate-street, occupied by Mr. W. Fenn. An alarm was immediately given by the police, and almost directly afterwards a body fell heavily from one of the upper windows in Bath-street, which proved to be that of a young man named Alfred Cookson, aged 24, who lodged in the house. Mr. Fenn effected his escape by crawling along the shores, which extended across Bath-street, into the opposite house. Shortly afterwards two persons appeared at the second floor window in Newgate-street imploring help. The police and others begged of them to wait until proper assistance arrived, and in a few minutes the Royal Society's fire-escape, accompanied by Conductor Carey, came up from the Royal Exchange station. Placing his machine against the building, Carey ascended to the relief of those above, and safely brought down a man and a woman, amid the cheers of the assembled crowd. Fire-escapes from Hatton-garden and Bridge-street closely followed the first, and a report having been spread that another person was still in the house, Conductor Sunshine ascended, and although at first beaten back by the smoke, he ultimately accomplished a search of every room, and pronounced them tenantless. The Brigade, parish, and West of England engines were promptly on the spot, and the fire soon mastered. Mr. Cookson was carried to St. Bartholomew's Hospital, where he shortly after expired. At the coroner's inquest, before Mr. Payne, the surgeon's evidence went to prove that the deceased had not sustained any serious injury from his fall, but had died from the effects of severe burns.

It appeared that on the first alarm of fire he must have attempted to escape down the stairs, which were enveloped in flames; that in this attempt he got severely burned, and, returning to his room frantic with pain and fear, he threw himself out of the window. Had he waited a few minutes, he might have been saved by the fire-escapes; or had he remained in his own room he would have been in no actual danger, as the fire never reached it. How forcibly this unfortunate young man's fate illustrates the truth of the poet's moral,

"Beware of desperate steps!—the darkest day,
Live till to-morrow, will have passed away."

The origin of the fire was traced to a dust-bin in the cellar, immediately under the staircase. It would seem that some hot cinders had been thrown into the dust-bin late on the previous night, which, igniting the contents, set fire to the staircase, and caused the calamity as described. After a lengthened investigation before Mr. Payne, the city coroner, the jury returned a verdict that "the deceased was accidentally burned to death by a fire which happened at No. 76, Newgate-street, but how that fire originated there was no evidence to show. The jury complimented Mr. Braidwood "for his vigilance upon this occasion," and expressed their great satisfaction at the prompt attendance and meritorious exertions of the conductors of the Royal Society's fire-escapes, "but for whose exertions two more lives must have been sacrificed!" The conduct of the police was also commended. The Royal Society for the Protection of Life from Fire awarded Conductor Carey their silver medal for his excellent conduct in this affair, and pecuniary compensation was given him by some of the neighbours.

Sunday, Sept. 13, 3¼ A.M. The numerous inmates of the lodging-house of Mrs. Mathews, No. 36, Little Bartholomew-close, were thrown into great consternation by the discovery of a fire raging

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below. On going down stairs the flames were seen breaking through the partition of the ground floor back room, and communicating to the staircase. Water being procured, a successful effort was made by the inmates and neighbours to extinguish the fire; this was soon accomplished, when the dead body of Mrs. Gold (the inmate of the room) was found upon the floor, with nothing on but a small portion of her shift and her stockings.

At the inquest, it transpired that the deceased had latterly indulged in habits of intemperance, and was intoxicated when last seen alive on the previous night. It is supposed that by some mismanagement of her candle she occasioned the fatal conflagration. The witnesses expressed their opinion that the fire had been burning for some time, and that the deceased was dead long before the fire was discovered. The jury returned a verdict of "accidental death," accompanied with an expression of admiration at the prompt attendance and good conduct of the Royal Society's men, Wilson and Sunshine, who were on the spot with two fire-escapes in a few minutes, and notwithstanding the smoke, and the assurances that all the inmates had escaped, ascended and searched every room. The jury also noticed the exertions of the men who extinguished the fire, and asked Mr. Payne, the coroner, if he had any fund at his disposal out of which they could be remunerated for their praiseworthy and successful exertions. Mr. Payne regretted that he had no such fund at his command, and expressed a wish that the inhabitants of London would enter into a subscription to establish a fund, out of which he might be enabled to reward the meritorious exertions which so frequently came under his notice.

Friday, September 18. An unfortunate accident occurred at No. 3, Stringer's-row, Lower Road, Rotherhithe. Mr. Tippett, an oil and colourman, accidentally spilled four gallons of turpentine in his kitchen, which flowing over the floor extended to the fire-place and ignited. The flames soon spread, and although assistance was promptly afforded, no water could be obtained for nearly half an hour, and the premises were destroyed in consequence. Mr. Tippett himself was dreadfully burned.

Wednesday, Sept. 23, 3¼ A.M. A fire of a fearful character broke out at the Croydon Station of the London and Croydon Railway. The fire commenced in the carriage depôt, a building 120 feet long by 40 broad, filled at the time with first and second class carriages. The parish and barrack engines were brought out, but they were unable to cope with the devouring element, which shot through the roof and illuminated the sky. The light being seen in town, a number of engines started for the scene, Mr. Connorton, with the West of England engine, was the first to arrive, Mr. Braidwood with the Watling-street engine was next, followed directly after by Mr. Garwood with the County engine from Regent-street. The supply of water was unfortunately very limited, but the firemen did the best they could with what was obtained, and succeeded in stopping the fire just as it was reaching the ticket station and booking offices, which they preserved. The carriage shed and fourteen carriages were entirely destroyed, and considerable injury done to the permanent way.

An inquiry was instituted by the directors, from which it appeared that the conflagration was occasioned by the spontaneous ignition of some greasy cotton wipings. It is a most remarkable fact, that nearly every fire that has happened upon the metropolitan railways is believed to have originated from spontaneous combustion.

Friday, October 9, 9½ P.M. Another fatal fire from firework-making occurred at the house of Mr. Sharp, No. 30, Kent-street, Borough. Mr. Sharp, at the time stated, was absent from home, his wife, three daughters, and an apprentice being engaged in making fireworks in the parlour at the back of the shop. From some unknown cause an explosion took place, which communicated to a large stock of fireworks in the shop. Assistance was promptly afforded, and the fire soon extinguished, when the lifeless body of Miss Ellen Sharp (aged 18) was found behind the counter; a younger sister and the apprentice were got out of the back parlour in an almost lifeless condition, the latter subsequently expiring in the hospital. An inquest was held upon the two unfortunate sufferers before Mr. Payne, who observed that, "The manufacture of fireworks in such a place was clearly illegal, and the jury might make the party criminally responsible for the consequence." The jury returned a verdict of "accidental death," adding, "that they consider the conduct of Mr. Sharp highly censurable in permitting the manufacture of fireworks by his children, and in so densely populated a neighbourhood."

The firemen and engines had scarcely returned to their stations from the above fire, when another broke out, at 10¾ P.M., in the extensive premises of Mr. Cowper, linendraper, &c., No. 144, High-street, Borough. The Brigade, West of England, and County engines arrived in rapid succession; but for upwards of half-an-hour no water could be obtained from the Southwark mains; a strong force of firemen and engines stood powerless by, while the flames extended from floor to floor with amazing rapidity, and the building, with its valuable contents, was nearly consumed before water was obtained.

Friday, November 6, 8¼ A.M. A fire, attended with loss of life, was discovered in the house of Mr. Shanks, No. 18, Powell-street East, King-square, Goswell-street. It appeared that a Mr. Henry Rigden, who lodged in the first-floor back room, came home at a quarter past three o'clock, intoxicated. He was let in by Mr. Shanks, who saw him safe into his room, and left him about an inch of candle lighted. In about a quarter-of-an-hour afterwards, Mr. Shanks went down to see if the candle was extinguished, when all appeared safe. Mr. Shanks rose at six o'clock to go to his employment, and, on passing Mr. Rigden's door, heard him coughing, but took no notice of that circumstance, and the family and domestics passed the room-door several times in the course of the morning, but perceived no smoke or smell of fire. Shortly after eight o'clock, another lodger coming down stairs, found the partition very hot, and, on opening the door, found the room in flames. An alarm being given, the Brigade and West of England engines soon attended and extinguished the fire. The first and second floors were seriously damaged, and the second flight of stairs destroyed. The body of Mr. Rigden was found lying in the feathers of his bed, burned to a cinder.

An inquest was held before Mr. Baker, when the preceding facts were established. The writer, who was present, stated, "That the body of the deceased had evidently been exposed to the action of fire for two or three hours; that nothing but long-continued exposure to fire could have reduced it to its present state. It seemed probable that deceased had lighted a cigar before the candle was extinguished, and after smoking had dropped the end of the cigar on his bed, which smouldered, and filled the room with smoke, by which the deceased was

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suffocated. When he was heard coughing at six o'clock, he was doubtless inhaling and struggling with the smoke. The draught of the chimney carried off all smoke and smell of fire from the house, the influx of air being through the interstices of the door. A very extensive charring of the room took place, until the door was opened, which fanned the burning embers into a flame which soon spread. The jury agreed in this view of the case, and returned a verdict of "Accidental Death."

Wednesday, December 2, 3¾ A.M. A fire broke out at Mr. Ferguson's Wax-work Exhibition, 32, New Cut, Lambeth. The fire commenced in the exhibition-room, and raged most furiously. The Brigade and West of England engines, from Waterloo-road, were on the spot instantly, and soon in full work. The flames had got so much a-head when discovered, that to enter the premises was impossible. As soon as the fire was extinguished, Mr. Barrow, deputy-foreman of the West of England fire-office, ascended the scaling ladders, and found the body of Mary Ann Robertson, a female dwarf, 16 years of age, lying partly on the bed in the second floor back room, quite dead. Some parrots, a goat, and a monkey were got out alive; the latter animal having had the sagacity to envelope himself in the green baize of the exhibition-room! Others of those animals, forming part of the exhibition, perished. An inquest was held before Mr. Cartar, when the jury returned a verdict "That the deceased died from the effects of burning, caused by the house having accidentally taken fire."

Sunday, December 20, 1½ A.M. It was discovered that a fire had been burning, under the following singular circumstances, in the house of Mr. Hill, boot and shoe maker, 28, Cannon-street, Saint George's-in-the-East. At the time stated, Mr. Hill opened the door of his bed-room, on the second floor, and found the room full of smoke; he immediately shut the door, and ran to the nearest fire-engine station for assistance. On the arrival of the firemen the smoke was permitted to escape, but no fire could be seen. When the room was completely cleared, it was found that the bed furniture, of white cotton, was nearly destroyed by fire; the blankets, sheets, and feather bed considerably damaged, and one end of the straw mattress so much burned that the straw was protruding, and had evidently been on fire, still not a single spark of fire remained. A chimney-board was placed against the fire-place, open about half an inch at the bottom. The last person in the room was a girl, about two hours before, and it is supposed a spark from her candle had fallen on the bed curtains unperceived. By shutting the door, however, and thus depriving the fire of fresh air, it never broke into a flame, and the house was in all probability saved.

It is not to be supposed that fires generally can be extinguished by merely shutting a door, but by so doing the progress of the flames is much retarded, so as to give sufficient time for the escape of the inmates, and the arrival of proper assistance.

Thursday, December 24, 3¾ A.M. A fire broke out in the house of Mr. Banfield, cabinet-maker, No. 20, Edward-street, Foley-place. At the time of the outbreak there were nine persons asleep in the house, comprising the families of Mr. Banfield and of a lodger named Hatchwell. On being roused, the utmost confusion prevailed, the flames having cut off the retreat of the inmates. On hearing the alarm of fire, Conductor Boosey, with the Royal Society's fire-escape from Great Portland-street, proceeded to the spot; placing his machine in front of the burning building, he gallantly ascended, and brought down in perfect safety five persons and an infant; three others (all that remained) were rescued from the back of the house by means of his short ladder. A cabinet-maker's workshop adjoining the dwelling was destroyed, the back and front kitchens of dwelling-house burned out, staircase burned away, and part of roof off, as well as considerable damage to the rest of the building and contents.

Conductor Boosey's conduct was highly applauded, and he received a pecuniary reward from the Royal Society for the Protection of Life from Fire, as well as several presents from inhabitants of the vicinity of his station. But for his exertions the consequences would have been most disastrous. The prompt arrival of the Brigade, County, and West of England firemen, soon stayed the progress of the devouring element.

Thursday, Dec. 31, 3 P.M. Being the last day of 1846, the directors of the several insurance companies were congratulating themselves on the trifling loss by fire in the metropolis during the year, and Mr. Braidwood, the Superintendent of the Fire Establishment, was about concluding his annual report of their numbers and extent, when intelligence was brought that Irongate Wharf was in flames! Fire engines from the Tower, St. Katharine's Docks, the Brigade and West of England stations, followed each other in rapid succession. The floating engines from Rotherhithe and Southwark bridge were brought up and set to work as speedily as possible. Unfortunately a great deficiency of water prevailed on shore, and the tide being down the floating engines worked under much disadvantage. In spite of these and other difficulties, however, the firemen exerted themselves to the utmost, but by the time the engines could be got into efficient operation, the wharf was in flames from end to end. As it was evident that all attempts to save this building would be fruitless, their attention was directed to the safety of those adjoining, and of the docks. Alongside the wharf were moored two vessels, the *Busy* of Bridport, and the *Hawk* of Montrose. Directly the alarm of fire was raised, both vessels were cut away from their moorings, but being low water they could not be got off; the flames soon reached them, and in spite of the exertions of the firemen the *Busy* was destroyed, and the masts, yards, and upper works of the *Hawk* burned.

On the east of the wharf the flames communicated to the "Marquis of Granby"—a large and well known public house; by dint of great exertion, however, it was preserved from material injury. The entire range of premises forming Irongate wharf, until within a few months previous, comprised three wharfs, viz.: Leith, Dublin and Aberdeen wharfs; from end to end it was exactly 212 feet, and nearly 70 feet wide. At the time of the outbreak the several floors were stored with a miscellaneous description of goods. In the lower rooms were casks of tallow, saltpetre, sulphur, oil, turpentine and other combustibles, nearly all of which were destroyed. A detachment of guards from the Tower, with 150 of the H and K divisions of police, were on the spot and rendered all the aid in their power, while a strong force of the Thames police performed the same duty on the water.

The following list shows the occupancy of the various premises, with respect to that portion of them in which the fire originated, thereby illustrating the comparative liability to accident by fire of various trades and manufactures, as compared with private dwellings:

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Apothecary	1
Bakers	15
Basket maker	1
Beer shops	6
Booksellers, binders and stationers	5
Boot and shoe makers	7
Builders	3
Butchers	3
Brush maker	1
Cabinet makers and upholsterers	15
Candle manufacturers	4
Cane benders	2
Cap maker	1
Carpenters, and workers in wood	21
Carver and gilder	1
Chair makers	3
Chandlers	7
Cheesemongers	3
Chemical works	2
Chemist (no laboratory)	1
Churches	3
Cigar manufacturers	8
Clothes sale-men	5
Coach makers	5
Coal merchants	2
Coffee roasters	5
Coffee shops and chop houses	13
Coopers	5
Confectioner	1
Cork burners	2
Corn chandlers	5
Curriers	2
Dextrine flower maker	1
Distillery	1
Druggists, wholesale	2
Dwellings, private	268
Dyers	2
Engineers and smiths	11
Eating houses	5
Exhibition	1
Farms	4
Feather-bed makers	2
Fellmonger	1
Felt patent, manufacturer	1
Firework makers and dealers in	7
Flax dressers	3
Foundery	1
Furriers	2
Glue maker	1
Gold beater	1
Greenhouse	1
Grocers	11
Hatters and hat makers	6
Hat-box maker	1
Hoop bender	1
Horse-hair and cocoa-nut fibre manufacturers	3
Hot presser	1
India-rubber merchants	2
Ink manufacturer	1
Japanners	4
Lime barge	1
Lime wharf	1
Linendrapers, hosiers, and lacemen	24
Lodgings	101
Lucifer-match makers	5
Maltster	1
Map mounter	1
Marine stores, dealer in	2
Oil cloth, and table cover manufacturers	3
Oil and colourmen	11
Oil merchant	1
Pasteboard manufacturer	1
Piano forte makers	3
Printers, letter-press	3
Printers, steam	3
Prisons	2
Rag merchant	1
Railway stores	3
Refiner, metal	1
Rope maker	1
Sack merchant	1
Saddler	1
Sail makers	3
Sale shops and offices	29
Saw-mills, steam	7
Ships	8
Ship, steam	1
Shipwright	1
Skindressers	6
Soap boiler	1
Soot merchant	1
Stables	17
Starch manufacturers	2
Straw-bonnet makers	5
Sugar refiner	1
Tailors	5
Tanner	1
Tan dryer	1
Tarpaulin manufacturer	1
Taverns and hotels	11
Theatres	2
Tobacconists	6
Turpentine works	1
Under repair, and unfinished houses	5
Unoccupied	2
Umbrella maker	1
Varnish makers	4
Victuallers, licensed	22
Warehousemen	2
Wax and tallow chandlers (not melters)	3
Wharfs	3
Wheelwrights	2
Wine, spirit, and porter merchants	8
Workhouses	3
Total	834

The causes of fire, so far as they could be satisfactorily ascertained, were as follows:

Accidents, for the most part unavoidable	19
Apparel ignited on the person	3
Bleaching basket	1
Candles, various accidents with	85
Carelessness, palpable instances of	13
Cats knocked down candles, clothes-horse, &c.	5
Coffee, chicory, &c., roasting of	5
Cork, burning of	2
Children playing with fire	17
——— candles	4
——— lucifers	4
Cinders put away hot	8
Curtains, bed, ignited	81
———, window, ditto	63
Drunkenness	9
Fires kindled on hearths, &c.	7
———, raking out on hearth	8
Fire sparks	32
Fireworks, making and selling	7
———, letting off	2
Flues, blocked up	12
———, defective	23
———, foul and ignited	29
———, overheated	14
———, ———, in next house	8
Friction of machinery	3
Fumigation, incautious	4
Furnaces	25
Gas, accidents in lighting	7
———, left burning too high	17
———, escape of, from street main	1
———, escape of, from defective fittings	20
———, hot-air pipe from burner	1
———, workmen repairing fittings	7
Hearth, defective	1
Kilns, overheated	3
Lamps, oil	4
———, naphtha	3
Lime, accidental slaking of	7
Linen airing before fire	39
Lucifer matches, using	5
———, making	1
———, accidentally ignited by a rat	1
———, accidentally ignited by sweeping	1
———, accidentally ignited by heat of sun	1
———, accidentally ignited in coat-pocket	5
Ovens, defective and overheated	7
———, coke	1
Pitch and tar, heating of	8
Reading and working in bed	3
Shavings, loose, ignited	35
Smoking saveloys	1
Spontaneous ignition of cotton	3
Spontaneous ignition of druggists' waste	1
——— of guano	1
——— hay	2
——— lamp-black	1
——— of oil and sawdust	1
——— of rags, wet	2
——— of rags, greasy	2
——— of sea-grass and linseed oil	1
——— of straw	1
——— tan	2
Stoves, drying	20
———, improperly set	5
———, overheated	13
———, pipe	5
Stills	3
Suspicious	7
Tobacco smoking	25
——— put in pocket unextinguished	4
Varnish, oil, and turpentine, boiling of	9
Wilful	19
Undiscovered	39
Total	834

The causes of fire continue to present matter for deep reflection to thoughtful minds. The singular character of some of the accidents, and the positive carelessness exhibited by others, are truly surprising, and lead us to wonder that

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fires are not more numerous than we find them. The gross negligence of workmen in putting up and repairing gas fittings, is a growing evil, leading to an increased number of accidents. The insurance companies very wisely decline to make good damages occasioned by explosions of gas—the damage *not* being by *fire*—which throws the sufferer upon his gas-fitter for redress, making him pay the penalty for his recklessness. This may in time work out a remedy, but the expense falls directly upon the master, who, unfortunately, has not always the means of fixing it upon the careless workman. One thing is certain—all fittings and repairs should be carefully tried and examined by the master himself, or by a foreman upon whose integrity he can rely. Of all the artificial lights, gas is the safest and most easily managed, under proper care; but from its subtle character, if negligently treated, it may become highly dangerous. The number of accidents from carelessness in "lighting gas," is still large, much larger than appears by this report, from the circumstance of the majority of these accidents not being made known to the firemen.

Nearly all these accidents might have been averted by the use of the "*spirit torch*;" an excellent registered invention, to be had at most ironmongers' shops throughout the kingdom.

Several curious accidents have resulted from lucifer matches, as stated in the foregoing table. The following singular occurrence is not included in that list: A journeyman baker in my neighbourhood was suffering from toothache in August last, and on going to bed one Saturday night, placed some lucifer matches under his pillow, in case he should want a light in the night. His expected tormenter did not molest his slumbers, but about two o'clock in the morning he was awoke by a most intense pain in his arm, which, greatly to his consternation, was enveloped in the flames of his burning bed. Having water at hand, he succeeded in quickly and quietly extinguishing the fire. Whether the heat of the bed, or the friction of the man in moving, caused the matches to ignite is uncertain; but the inference is, that under any circumstances *Lucifer* is a dangerous bedfellow.

Several decided cases of spontaneous combustion have been observed during the past year, some of which have occasioned very serious fires, involving the destruction of a large amount of property. The following singular case occurred in an oil and colour shop adjoining the baker's just referred to. On proceeding to open the shop one morning, it was found to be filled with a dense body of suffocating smoke, accompanied by a strong smell of fire; no fire was, however, perceptible. On instituting a strict search, the smoke was found to proceed from a paint pot, into which a small quantity of dry lampblack had been placed the night before. When discovered, it was just entering into a state of active incalescence, and was thrown out into the street. Had this taken place an hour or two sooner, it is most likely that the heat would have cracked the pot and scattered the ignited lampblack among the highly combustible matters with which the shop was filled; the house would have been burned down, and the origin of the fire involved in the most "impenetrable mystery."

The daily and hourly distribution of fires has been as follows:

Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.
103	110	127	119	1[illegible]0	141	131

	First Hour.	Second Hour.	Third Hour.	Fourth Hour.	Fifth Hour	Sixth Hour.	Seventh Hour.	Eighth Hour.	Ninth Hour.	Tenth Hour.	Eleventh Hour.	Twelfth Hour.
A.M.	47	45	31	35	23	10	14	10	21	13	29	25
P.M.	17	16	18	24	[illegible]6	40	45	46	65	87	81	56

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The *London Fire Establishment*, under Mr. Braidwood and his experienced foremen, have upon all occasions acquitted themselves most creditably; and while congratulating ourselves upon the trifling character of last year's fires, it must be remembered that very many of those fires have been circumscribed solely by the exertions of the firemen, and that frequently under circumstances of great difficulty and danger. In addition to the instances already noticed, this was especially the case at the fires of Mr. Jones, cabinet-maker, Castle-street, Finsbury, Jan. 31. Messrs. Grant and Co., sugar-refiners, Back-road, St. George's, Feb. 22. Mr. M'Neil's, patent felt-manufactory, Bunhill-row, Feb. 26. Mr. Carlin, tobacconist, Ludgate-street, March 8. Messrs. Poland and Co., wholesale furriers, Bread-street, Cheapside, March 9. Mr. Hunt, cheesemonger, Three Colt-street, Limehouse, April 10. Mr. Young, glue manufacturer, Spa-road, Bermondsey, May 4. Mr. Bailey, sail-maker, June 16, and Mr. Glendinning, corn and coal merchant, June 19, both in Bermondsey-wall. Mr. Jacques, saw-mills, Liquorpond-street, June 24. The Cooperage-yard, St. Katharine Docks, Aug. 3. Mr. Foletti, looking-glass frame manufacturer, Bateman's-row, Shoreditch, Aug. 30. Messrs. Gordon and Co., coopers, Limehouse, Oct. 29. The Garrick Theatre, Goodman's-fields, Nov. 4. Messrs. Whitten and Co., wholesale curriers, Parker-street, Drury-lane, Nov. 8. Messrs. Palmer and Co., candle-makers, Allen-street, Clerkenwell, Nov. 24. Messrs. Hitchcock and Co., saw-mills, Broad-wall, Lambeth, Dec. 4. Mr. Noblet, currier, Drury-lane, Dec. 19.,—all of which threatened destruction to the adjacent properties, but succumbed to the skilful and courageous exertions of the firemen.

The *West of England* firemen, under Mr. Connorton, continue to justify the encomiums given them in former years. The number of their attendances, and the order of their arrival, at fires are highly creditable. Their exertions on many occasions have drawn forth most unequivocal marks of approbation, and their conduct is every way worthy of the enterprising and daily-extending establishment to which they belong. It is gratifying to know that their employers appreciate their usefulness, and have just made most liberal arrangements for giving increased effect to their exertions.

The *County* firemen, under Mr. Garwood, continue to manifest the vigour which he infused into that establishment on his appointment. Their exertions at the western extremity of the metropolis have been very successful; not there alone, however, have they shown to advantage. At many distant fires they have been promptly in attendance, and exerted themselves to the utmost. A new and more powerful engine is richly deserved, and would be well handled by this corps.

The *Parochial Engines* of the metropolis still cut a sorry figure; attributable for the most part to the entire absence of encouragement. The annual stipend given by many of the largest parishes to their engine-keeper is paltry in the extreme; in addition to which, the rewards are cut down to so low a figure, that if an engine-keeper exerted himself in a proper manner at fires, he would find himself considerably out of pocket by the transaction. The rewards not being sufficient to reimburse the expenses inevitably incurred for calling, working the engine, and refreshments; to say nothing of his own time for half a day's work cleaning and oiling his hose, engine, &c. For this reason the engines of St. Pancras, St. Luke's, St. George's Southwark, St. Andrew's Holborn, and other large and populous parishes are useless. Happily, there are exceptions, and the successful exertions of Mr. Brown with the Islington engine, form a striking contrast to the preceding picture. The engines of Shoreditch (Clark), St. George's, Hanover-square (Turner), Paddington, Poplar, Marylebone, Whitechapel, and a few others, have been well handled on several occasions.

The *Police* generally have acquitted themselves well. Upon some occasions their conduct has been extremely judicious, but it is frequently difficult to make them understand the impropriety of breaking open houses before assistance arrives to take advantage of the entrance. Where a different line of conduct has been followed, and all kept close until the firemen were ready to dash in with the engine-branch, the best results have been attained.

The *Royal Society for the Protection of Life from Fire*, at the beginning of last year, extended their fire-escape sta-

tions into the City, and they have now an almost continuous chain of these useful machines from Knightsbridge-green to Aldgate, besides many others lying out of this line, as will be seen by the following list of the stations:*

No.

1. *Aldgate*, corner of Leadenhall-street and Fenchurch-street.
2. *Bishopsgate-street*, near Widegate-st.
3. *Royal Exchange*, by the Wellington statue.
4. *Cheapside*, by the western obelisk.
5. *New Bridge-street*, by the obelisk.
6. *Aldersgate-street*, opposite Carthusian-street.
7. *St. John-street, Clerkenwell*, opposite Corporation-row.
8. *Holborn Hill*, corner of Hatton-garden.
9. *Strand*, by St. Clement's Church.
10. *Trafalgar Square*, by St. Martin's Church.

MR. BADDELEY, *Inspector*, 29, Alfred-street, Islington.

11. *Bedford Row*, south end.
12. *King's Cross*, Battle Bridge.
13. *Foundling Hospital*, Guildford-street.
14. *Hart-street, Bloomsbury*, by St. George's Church.
15. *Tottenham Court Road*, by the chapel.
16. *Great Portland-street*, by the chapel.
17. *Oxford-street*, corner of Marylebone-lane.
18. *South Audley-street*, by the chapel.
19. *Eaton Square, Pimlico*, by St. Peter's Church.
20. *Brompton*, by Knightsbridge-green.
21. *King-street*, Baker-street.
22. *Edgeware Road*, near Cambridge-terrace.

MR. SPENCER, *Inspector*, 7, Great Portland-street, Portland-place.

At each of these places a fire-escape is stationed nightly, attended by a conductor who is well experienced in its use. The conductor is dressed in a neat brown uniform with cap and buttons; he is equipped with a belt, axe, crowbar, &c., and it is his duty to attend all fires in his neighbourhood upon the first alarm being given to him. The conductors are visited at uncertain periods throughout the night by their inspectors, and also by other officers of the society. Any breach of discipline is severely punished, and inebriety subjects the offender to instant dismissal. The commissioners of the Metropolitan, and also the commissioner of the City Police, have given assurances of the kindest co-operation in the humane and benevolent object of the society; and their men have, generally, most cordially assisted the society's conductors.

* Since this article was written, a station has been determined upon at Islington-green, which will be completed as soon as possible.

The society have promulgated the following rewards to induce persons to call and assist the conductors:

	s.	*d.*
The person giving an alarm to the fire-escape conductor, whereby he is enabled to arrive at the fire *before an engine*	2	6
If arriving after an engine	1	6
To two other assistants .... each	1	0

Any person rescuing an individual from fire will be rewarded by the society.

There are still many localities unprovided with fire-escapes, and the society being from experience convinced of the necessity of increasing the number of fire-escapes, and also of the inutility of ladders or other machines, unless attended by persons fully prepared, and having a perfect knowledge of the use of the same, earnestly call upon the public to aid their endeavours in supporting the present necessary expenses, and to increase the number of the escapes, and enlarge their sphere of usefulness generally.

In order to show the efficient working of the present system, it is only necessary to observe, that out of one hundred and fifty fires that have occurred in the society's districts during the hours of duty, *one hundred and forty* have been attended by one or more of the society's escapes, the others being such trivial cases that no call was given at their stations.

In addition to the cases already noticed, the society's conductors have been the means of saving life at the following fires:—Monday, March 16, 2½ A.M. At a fire which broke out in the cellar of the White Hart public-house, 18, Coal-yard, Drury-lane, conductor Chapman was promptly in attendance with his escape from Hart-street, Bloomsbury. The inmates were said to have escaped, the house being filled with smoke; on searching, however, Chapman found a female in bed on the second floor, near her confinement, and almost suffocated with the smoke. She was brought down and placed in safety, and soon recovered.

Friday, 11th Sept., 1¾ A.M., a fire broke out on the premises of Mr. Phipps, harness maker, 243, High Holborn, which was immediately attended by conductor

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Christianson. Being informed that one of the inmates was missing, he ascended and searched the upper floors, but could find no person there; he then proceeded to the roof, where he found a man powerless from suffocation. His rescue was, happily, effected before the fire reached that part of the building.

This is decidedly a *popular* and *public* institution; its performances within the limits to which subscriptions have hitherto permitted its extension, have been most gratifying. Let us hope that the demonstration of usefulness already afforded, will induce the extension and permanent establishment of so humane and benevolent a society.

29, Alfred-street, Islington, March 17th, 1847.

MR. HENSON'S PATENT RAILWAY CARRIAGES FOR THE CONVEYANCE OF PASSENGERS, GOODS, AND CATTLE.

Fig. 1.

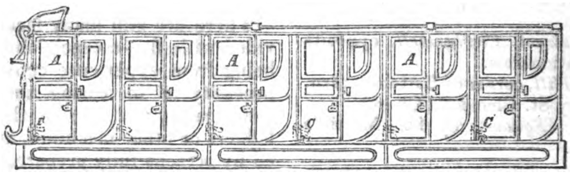


Fig. 2.

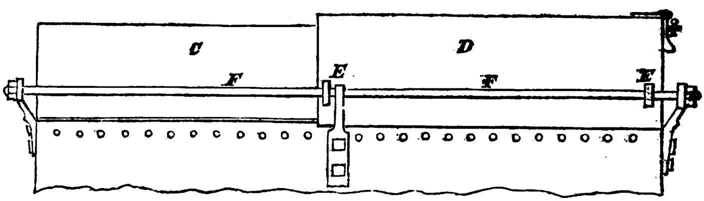


Fig. 4.

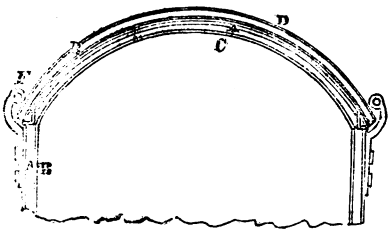


Fig. 3.

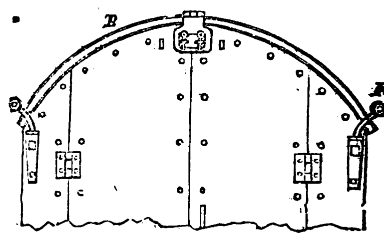
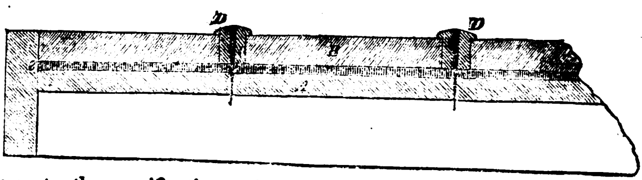


Fig. 5.



We return to the specification of Mr. Henson—whose simple and ingenious mode of transferring carriages from one railway gauge to another we described three weeks ago—for the purpose of extracting from it the following particulars

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of his improvements in the construction of railway carriages. Mr. Henson, it will be seen, aims not only at such an increase in the strength of passenger carriages as would greatly diminish the risk of injury to life or limb in the case of accidental collision or overthrow, but at introducing into them a degree of comfort and luxury much exceeding any thing yet enjoyed by the public. Goods carriages he would make so secure from sparks, that even gunpowder (now a prohibited article of traffic on railways) might be carried with perfect safety. And for cattle wagons he has a plan which should obtain for him the thanks of the whole agricultural body. One may reasonably doubt whether such a luxurious fancy as Mr. Henson's "Serial Coupé" will be very soon realized in practice; but we can entertain no doubt whatever, that improvements of so practical a character, so much needed and so much in the interest of railway companies themselves, as those, embodied in the goods and cattle wagons, must speedily meet with universal adoption.

1. *Passenger Carriages.*

My invention consists, *secondly*, in an improved mode of constructing the bodies of railway carriages, and in the method of staying and binding together the several parts of which the same consist, so that these parts shall not be easily damaged, and the risk of accidents to passengers be greatly lessened. I form the carriage body framing of iron, and take special care that the framework of the partitions inside shall be well suited to withstand pressure from without, so that it may support the roof and sides in case of the carriage being overturned. The basis of each partition is formed of a circular hoop or ring of iron bound together by two cross stays, one of which connects the roof and bottom. Over a finished frame-work of this description I put a covering of iron plate. The entire side of a carriage body may be formed out of one plate, or it may be covered with a number of plates cut into suitable forms, and securely connected together. Fig. 1, is a side elevation of the body of a railway carriage, constructed on the same principle as the preceding, in which the seats are arranged in a different way from that ordinarily adopted. The whole of the outer plates are fixed to the inside framing with rivets, between the heads of which and the plates through which they are passed, there is interposed a layer of felt. Each of the compartments, A A A, of this carriage, is provided with only one seat placed towards the back of the carriage, so that the passengers may sit with their faces in the direction the carriage is advancing. Many obvious advantages will attend this serial *coupé* arrangement, both as regards the convenience and safety of the passengers. At bottom there are inclined boards for resting the feet upon. Each board consists of an under or foot flap, covered with sheep skin, having the woolly side uppermost, and of an upper flap or board, similarly covered on the lower side, the intervening space being of sufficient size to allow of the introduction of the feet. Several other modes of stuffing and covering these foot-boards, in order to afford protection to the feet from the effects of cold, will readily suggest themselves. In each partition of this carriage there is placed immediately opposite to, and about the height of the face of the passengers, a broad band of padding, formed of sponge or other like soft and elastic material, inclosed in a cloth or leather case, and extending from one side of the carriage to the other. Should any sudden shock be given to the progress of the carriage, little or no damage would be sustained by those who were in it, and especially the head, which is most liable to injury, would be protected by the padding.

The plan which I have just before described of forming the carriage with a number of single-seated or serial *coupé* compartments, may be carried out with equal advantage in the construction of carriage bodies, whatever may be the materials they may be formed of, whether iron or wood, or a combination of the two.

2. *Goods' Carriages.*

My invention consists, *thirdly*, in an improved mode of constructing wagons or trucks, to be used in the conveyance of goods and cattle on railways, and which has for its object, first, the rendering of this class of carriages, and the goods they contain, more secure from destruction and damage by fire and wet than at present; and, second, the rendering of them much more durable. Fig. 2 is a side view of the top portion of a fire-proof goods' truck of my improved construction; fig. 3 an end elevation; and fig. 4 a section of fig. 1. All the under parts, namely, the under carriage and wheels, may be the same as in ordinary carriages of this class; the upper part or body I construct of fire and waterproof materials, with a covering of the same description. The whole of the framing, A A, is composed of iron ribs, joined

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either by bolts and nuts, or rivets, and over this framing there is put a covering of iron plates, B B, both on the inside and on the outside. C C is a fixed portion of the roof, or cover, which is constructed in the same manner as the body; D D is a movable portion of the roof, which is supported by four eyes, E E, two attached to the roof, on each side, which eyes slide upon two parallel rods, F F, so that the movable portion of the roof can be slid entirely back upon the top of the fixed part, C C, and thus allow of goods being conveniently packed, or removed. The whole of the parts when closed up are jointed sufficiently close to prevent the admission of any burning embers ejected from the locomotive engine. Besides, a wagon body constructed in the manner just described, with a space between the external and internal sets of plates filled with atmospheric air, which is a bad conductor of heat, would for a long time obstruct the progress of fire. And, moreover, it would afford complete protection, not only from wet, (without the use of tarpaulins,) but from abstraction of the contents of the wagons.

Sometimes, instead of making the body as before described wholly of iron, I make the framing and internal covering entirely of wood, and then cover this over with plates of iron, zinc, or other metal, so as to render it secure both from fire and wet.

3. *Cattle Wagons.*

The framework in this case is constructed of two and a half inch angle iron, and the sides and ends are enclosed with iron bars or rods, placed about four inches apart, and partially covered with sheet or galvanized iron plates, riveted or screwed to the rods. The roof is formed of light metal plate. The floor is covered with asphalt, or slate, or tiles imbedded in cement laid upon the deal boarding. The manner of fixing the riage; B B are two rows of tiles; C C, fillets tiles, and for preventing their being easily disturbed, is shown in fig. 5. A A is the boarding forming the bottom of the carof wood, of the peculiar form represented, which secure the tiles by projecting ledges; D D being themselves either fixed to the bottom planking with screws or nails. The rows of tiles and fillets run crosswise over the bottom of the carriage, that is, at right angles to its length, which permit of the whole being easily cleaned out. To facilitate the cleaning still further, the surface of the tiles are a little higher than the upper surface of the outside rails of the under carriage framework; or, instead of covering the under flooring with tiles, as just described, it may be made flush with the upper part of the side rail of the under framing, and the whole covered with sheet lead, having a slight inclination from the centre of the carriage towards each side.

There are three doorways placed on each side of the truck, and it is divided into separate stalls, three in width. Fence bars of iron are hinged to the partitioning of the stalls, at those places where there is no boarding or other fixed partition. The animals are driven in at the centre door to the stalls; but, on being removed, the end doors are opened up, (the fence bars being removed at the same time,) and the animals led out through them, whereby all the trouble and waste of time usually occupied in backing them out of their places are avoided. In constructing these wagons, I use the same method of bedding the heads of the rivets in felt that has been before described.

SCIENTIFIC MORALITY AT CAMBRIDGE.

(Continued from page 272.)

Sufficient illustration has been furnished, we presume, to render the mysteries of the Cambridge system of book-manufacture intelligible to our readers; and we conceive that the proceedings which we have already exposed will justify the severest reprehension that language can express. Of extenuation and defence we have published every line that has reached us; though we certainly have suppressed some of the boldest—nay, most audacious—denials, that it has ever been our lot to read, of the validity of our charges. We have given dates, facts, and references; and our readers are now in a condition to judge for themselves. As far as we ourselves are concerned, we might fairly leave the matter as we left it last week, and with entire confidence in the verdict of the public on the cases we have laid open. Yet we are entitled to recapitulate the import of the evidence adduced, and add a few concluding remarks on the *tendencies* of the modern Cambridge system of conducting the book-trade.

First, then, of Mr. Griffin's piracy of Mr. Hopkins' work on optics. We have heard in *conversation* such logic as the following:

"Mr. Griffin paid Mr. Hopkins for his tuition;—his tutor was bound in

honour to give him the best instruction and information on optics as well as other subjects;—the pupil paid for that knowledge, and was entitled to use it as may best answer his own purposes in after life;—Mr. Hopkins having thus sold his right to the pupil, he had no just cause of complaint against Mr. Griffin for making the most of his bargain;—and, finally, that the greater part of the matter itself was taken from Coddington's work on the same subject."

No one has ventured, however, to so defend that gentleman *upon paper*, and on his own responsibility. We believe, indeed, that, with the exception of Dr. Roget's defence of his plagiarisms from Dr. Grant's Lectures, such a doctrine has never been adventured on, even by the most reckless and least principled casuist; and the execrations which the medical plagiarist drew upon himself by the avowal of such a moral creed, from his professional brethren, was such as, we should think, would deter the most unblushing charlatan from repeating the experiment.

Now, we ask those who defend Mr. Griffin's conduct in this particular (and we impugn it in no other, be it remembered,) whether the *usual understanding* of the relation of tutor and pupil is not that of its being "confidential?" The tutor only engages to instruct; the supply of materials for a book is no part of the contract either expressed or implied. As far as a better arrangement of a subject for the student's reading is concerned, the pupil is entitled to it, provided the tutor is in possession of such an arrangement; but the object of the pupil is to get his degree, and consequently to arrange his acquirements in the order that is most readily available in the college and senate-house examination. The duties of the one and the claims of the other of the contracting parties close here; and as a tutor's income depends upon his reputation, and that reputation upon the success of his pupils in their examinations, it is quite clear that the pupil is *bound in honour* to make no ulterior use of that part of the tutor's machinery for education—and, least of all, his personal researches, arrangements, or manscripts. They are a part of his "stock in trade," and should be held as sacred as his chairs and tables; they also contribute to his *reputation*, which is another important element of his worldly success; and we see as little justice in depriving a man of that which contributes to his reputation, as in maligning the character he has already gained. Mr. Hopkins has no *legal* remedy; but surely the dignitaries of Cambridge will not look on such dishonourable doings with their accustomed apathy! Every tutor is interested personally in this case of casuistry; and the university officers, from the highest to the lowest, are interested in the fair repute of their community.

As regards the greater part of the MS. being taken from Coddington's work, we have simply to say, that, if there were no important additions made to that treatise, there was no call for Mr. Griffin to publish his work at all; and, at the utmost, it only shifts the question from the surreptitious use of a manuscript to the equally surreptitious appropriation of a printed book. It is in both cases *bad faith* with the public:—in the former the enormity is somewhat enhanced by his *also* breaking faith with his friend and tutor.

We come in the second place to notice one remark that has been made by our correspondent, "P. P." He questions whether Dr. Whewell had "complained" of Mr. Snowball's appropriation of the materials in his (Dr. Whewell's) several editions of his mechanics. A resident M.A. of Cambridge also says, "We know nothing here respecting Dr. Whewell's opinion on the subject. We can only guess at the sentiment any honourable man would feel, on finding his work pirated without improvements, under the shelter of a great name—as that of Dr. Wood unquestionably is." Whether we read Dr. Whewell right or not, we shall not discuss, but simply refer to pp. 199, 200, of his work "Of a Liberal Education." Obscurely as that passage is written, we can draw no other conclusion from it than the one we have drawn. Whether he meant it as a "complaint" or not, we can only state our firm conviction that the occasion gave good ground for complaint. Whether, therefore, the Master of Trinity (no Baal of our worship be it understood) complained or not, we do not see that the case, as against Mr. Snowball, is at all affected in regard to the moral principle involved. It matters not one iota

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whether we attribute to Dr. Wood or to Mr. Snowball the improvements which had been introduced into the Cambridge course of mechanics by Dr. Whewell, but the censure passed upon Mr. Snowball, for foisting upon Dr. Wood those mechanical principles that it is certain Dr. Wood never entertained, led that gentleman to print a *new title-page* to the work, as follows:

"The Elements of Mechanics. By J. C. Snowball, M.A., Fellow of St. John's College, Cambridge. *The Second Edition*, 1845."

In either case, therefore, Mr. Snowball has been trading under false colours; and we will afford him the benefit of choosing upon which horn of the dilemma he will be transfixed.

It only remains, in the third place, to notice the duplicate defence of Dr. Hymers, by "P. P." and "Q. Q.," which are printed in our last number.

We deem it necessary, in answer to the hint of "P. P." of our being actuated by "personal pique," to state simply, that we have no other motive than the condemnation, in the strongest terms that we can use, of the system of literary plunder which we have described. Under whatever name it had appeared, our remarks would have been precisely the same. We do not even personally know Dr. Hymers, and very possibly he may be, in all the ordinary relations of life, as bright an example of rectitude as any of us. It is not the *man*, but the *system*, that we condemn;—or if the man, yet only as one of the organs by which a pernicious principle is carried out. We condemn the low standard of right and wrong in literature which is admitted into Cambridge ethics; whilst in anything else than literature the principle would, we honestly believe, be repudiated even by the men who adopt it in this one particular. Unhappily, the same principle runs through all the public institutions of the country; but it has not been so largely developed in this particular form—at least in so ostensible a form—as amongst the men of St. John's College of recent times. To "make the most of office," in any of the ways by which it can be done, is only too general a rule of conduct with public men; but we do expect to see a better form of its development, instead of a worse, by university men—by divines and scholars. This, then, not "personal pique," has been our sole object in denouncing this discreditable principle. We would have, indeed, omitted all names, if we could have rendered our strictures intelligible and effective,—if merely general censure had afforded the least prospect of amending the evil.

Again, we are accused of writing in a spirit of hostility to Cambridge, because "the non-academic mathematicians are not noticed" by the university. Far from it; for towards Cambridge or Cambridge-men, *as such*, we have no unkind feeling. We do indeed feel indignant at the quackeries which we daily witness, perpetrated under the shield of a Cambridge degree.* It is against these, and against the arrangements of the academic system which facilitate them, that our hostility is directed, and will be continued in spite of innuendos like that we have referred to. We know sufficiently well that *we* can write nothing worthy of being quoted or referred to at Cambridge; albeit, we do now and then find some of our own researches dished up, even after we had almost forgotten them, in Cambridge papers and Cambridge pamphlets. Non-academic men expect no Cambridge recognition of their labours in any other form; but if they can even thus promote mathematical science, they will not have lived wholly in vain,—though, as usual, they die unrewarded either by emolument or reputation. Yet it cannot, surely, always remain thus:—monopoly must give way in learning as it has already done in political concerns. Still the time is not yet.

We cannot but think the *defence* of Dr. Hymers, on the ground of his having "purchased the copyright of Maddy's Astronomy," and then claiming the *authorship* of the work as a right, to be most extraordinary. Apply the principle generally to the publication-trade, (Dr. Hymers is the *publisher* of the books that bear his name—a very unusual, though perhaps in some respects a desirable arrangement,) and we shall have some few most wonderfully voluminous authors—say the Longmans, Whittaker, Parker, &c. Is not the absurdity apparent on the first blush of the proposal?

* We shall shortly give a most remarkable instance of the influence which Cambridge exercises even in the *public service*—probably in our next number.

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How can it cease to be absurd upon a small scale—even upon the limited scale of Dr. Hymers's publication-trade? Still, however, the *absurdity* is the least part of the objection which we take to the proceedings of Dr. Hymers and Co.

There are two modes in which an assumption of this kind acts perniciously, and in some degree immorally: first, in order to obtain an unearned reputation on the part of the person whose name is appended to the book; and, secondly, to secure the sale of a work by appending a name of reputation, as that of the author, whilst it was not written by him.

As regards the vanity which seeks to gain a reputation founded on merits not the ostensible author's own, it is of that grovelling kind which animates vulgar people to seek social credit by means of *seeming* to deserve it; whilst, in fact, there is not the slightest ground for their pretensions. Literature and science are now coming in for a share of the patronage of this class, as well as dress, equipage, and the hundred vanities that lead to half the ruin that is spread through the middle class in England. In literature this has been carried to a lamentable extent; and we see advertisements of "literary assistance," in the daily papers, so often, that we are convinced that the practice is on the increase. Indeed, in London there is an establishment opened for this professed purpose. Authorship is the rage of the idlers and triflers of the day; and a few pounds paid for a manuscript, with a few more for a printer's bill, will procure for the "tuft-hunter" and the "diner-out" a reputation that shall be his passport into the "best society." This vanity of weak minds will perhaps be more pardonable, than where the object is to acquire a *status* amongst literary and scientific persons by means of pretensions that can only be called by the plain name of *imposture*. Now we *know* that there are men, members of learned societies too, who have no better claim than this to their societal *status;* but we are far from imputing to Dr. Hymers any motive of this nature in the adoption of Maddy's "Astronomy," behind his own title page. We have however seen, in our time, more than one great scientific personage drop down into mediocrity, or disappear altogether, after the death of a poor and dependent scholar on whom the opulent *savant* condescended to bestow the "light of his countenance" and his patronage!

The second motive is the most general one. We have had some extraordinary instances within the last year of the system of lending names (or rather *selling names*) for the purpose of enforcing a sale of the most inferior works—and of these none more remarkable than in Halliwell's "Royal Letters." We leave to our readers the task of informing themselves upon these and collateral matters through the pages of our able cotemporary, the *Athenæum.* If Mr. Maddy sold the *authorship* as well as the *copyright* of his book to Dr. Hymers, we cannot well see how he or Dr. Hymers can escape the castigation inflicted on the Shoberls, Mr. Halliwell, and several others by the journal in question.

To our purpose, however, except as a question of scientific good faith, both these views of the question are somewhat indifferent. Let us make our own objection plain by a fact—which some people would call "a take-in" on the part of Dr. Hymers.

We had possessed a copy of Maddy's Astronomy almost from the time of its publication; and we thought it a moderately good treatise for the purpose it professed—though, as "Q. Q." says, "much of it is in other works." Well then, seeing the advertisement of a new work on the subject by "John Hymers, B.D." a few years ago, we ordered this of our bookseller. Now, we ask, were we dealt fairly with in having thus been deceived into the idea that we were getting a new work, when it was only a new edition of a work already in our possession? Do we complain of unfairness without good cause? And is it likely that our case is a solitary one? We happen to know that it is not entirely solitary: but the number of the persons so "taken in and done for," is not the criterion. The act itself is morally indefensible, even had it failed to dupe a single person.

On the same ground, we complain of Dr. Hymers having foisted upon us mere translations of foreign books, which we had in our own collection, as well as large appropriations of English ones with which we were familiar. From a person in his position in the university, and his

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degree in divinity, we certainly expected something original—in the mode of developing science at least, if not large and original views with respect to its principles. We have bought his books, as they appeared, with that expectation, and how complete has been our disappointment in almost all of them, our readers have been already told. Our confidence in the Cambridge publications is destroyed by such bad faith on the part of their pseudo-authors. We should not have purchased professed translations of any of these books, more than we should have bought Hymers' Astronomy; but we have been little less than tricked into it, by the adoption of the system of publication, with slight variations, of the same book, with the translator's name, put instead of the author's, on the title-page. In the language of our correspondent, there is "much harm done here:"—much harm to the *character of the university*, and, collectively, much harm to the *pockets* of her majesty's loyal subjects.

To the non-academic student, often in the most confined pecuniary circumstances, and seldom able to purchase books without making what to him is a serious personal sacrifice, this system is peculiarly cruel. Our country schoolmasters, especially, are great sufferers; and when they make an effort to procure books at much inconvenience, it is anything but fair that they should only obtain the most commonplace matters in science, when they expect that some glimmerings of the chartered learning of the University of Cambridge is to reward them for the sacrifice they make. We do not *blame* any man for publishing a good elementary treatise, but commend him; but, to be good, it must be better than preceding ones—ay, much better, for good is, after all, a term of relation. It cannot, at any rate, be applied to a mere copy, with a different name in the title-page. The public expects the munificent endowments (especially those of the divinity colleges) of the universities to be applied to higher purposes than such as we have described; but the public expectation, it seems, is to end as most expectations do, in disappointment.

That this system has been lucrative to Dr. Hymers there is no doubt; especially as his books have generally "sold," and he is his own publisher. Yet we should not ourselves covet opulence, which a mode of business like this had contributed largely to create for us; and a mode of business, too, to which the respectable houses in the publication-trade would scorn to have recourse. We leave it, however, to others to judge as their dispositions lead them, and to Dr. Hymers the (by us at least) unenvied eminence to which he has attained in the "art and mystery" of book-manufacturing.

Of the value of Dr. Hymers' books as mathematical treatises we have not offered our opinion; nor shall we just at present. We shall, however, make a remark or two on the *peculiar merit* which to our friend "Q. Q." they appear to possess. We admit them to have that merit, since he says they have. But on what is this great excellence founded? We fear it tells too much—especially of the general character of the Cambridge system of reading.

The great object of a university education is to obtain *the degree*, not to acquire profound knowledge or to develop the inventive powers of mind. This degree must possess some extraordinary charm to render it such a universal object of young ambition; and that it is attainable without more than a very humble amount of learning, and without the slightest appreciation of the value of that learning, is a fact forced upon us by what we see of Cambridge graduates every day. The majority of every year's bachelors have no other end in view than to use the degree for ulterior purposes in the competition of life, as a make-weight against the superior acquirements of their competitors not so shielded by academic titles. However, it is not thus with all. Some "go in for honours;" although if the moderators would express their convictions candidly, few even of those who get them are men of high desert. Below the first twenty wranglers, and sometimes still higher up in the scale, there is seldom more distinguished ability displayed than may be found amongst the first twenty poll-men. The usual arrangement is, that the moderators of one year shall examine for the common degree the next; and hence we appeal to those who have filled both offices, whether our statement be not in the main correct. We, however, do not intend to pursue this subject further.

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Our business is with the system which produces such results.

This wholly turns on the mode of examination, which is mainly by papers—whence the "writing out" is the great test applied. He who can cram up in his memory the greatest number of pages of book-work, has the best chance of getting highest on the list. He who is the most dexterous in the legerdemain of symbolism (for the "problems" are almost wholly confined to this) will get the most "marks." Yet, what faculties of the *mind* are called into exercise in preparing for this kind of contest? Certainly, the *ratiocinative* occupy but a small share of exercise; and we cannot discover in the study of mathematics (conducted as it must of necessity be to meet such a mode of examination) the slightest intellectual advantages over the time-honoured but absurd classical studies of Oxford, as regards their intellectual tendencies. So long, therefore, as the objects of the university are confined to this mode of training mathematical parrots, we admit that Dr. Hymers did Cambridge "some service,"—as his books, we admit, are well adapted for "writing out;" and we admit, too, that they are much superior to some others which have been manufactured with the same objects, but to which we will no further refer here.

Far be it from us to make any insinuation that Cambridge produces no great men. There are too many unfading names on the Cambridge lists, both of past and of present times, to render such an insinuation anything short of sheer folly. Cambridge offers facilities for study —sincere and ardent study—that are nowhere else to be found in England; and many, very many, have profited by these advantages. Yet, these many are but a very small section of the whole that have obtained the Cambridge degree. Our objection is, that the honours which are won by the few should be appropriated by the many who do not deserve them; and our great objection to works like those of Dr. Hymers and his class, (under this aspect, at least,) is, that they tend to facilitate this superficial system of acquirement, and deceive a good-natured public into a belief that a degree from Cambridge implies, *necessarily and generally*, a large amount of mathematical talent. We object to the value of this writing-out system as a test of solid learning or of great intellectual power; and we object to the works which facilitate the feat of "writing out," on the ground of the indications which it furnishes, operating as an abuse of public confidence.

If we shall have pained Dr. Hymers and his coadjutors in these practices, we beg them to believe that we have done it "more in sorrow than in anger." We will even believe it possible that they had not once thought of the *consequences* of the steps they were taking and the mischiefs they were perpetrating, both as regards the character of Cambridge and the destruction of public confidence in scientific men. Their *motives* we do not scrutinize or impugn further than this—that, in putting forth those books, either pecuniary gain or ephemeral reputation must have been paramount to the promotion of the real interests of science. But their *acts*, in themselves and in their effects, we do most strongly censure. It is, indeed, high time that some very stringent "graces" should "pass the senate" for the correction of such glaring evils as those to which the yet-existing system gives birth, and of which these works are indicative; and, if we mistake not, those of last May will do a little, *though not all*, towards accomplishing a purpose so desirable.

CARRIAGE TRACTION—THOMPSON'S AERIAL WHEELS.

Sir,—The importance of disseminating by means of your journal correct mechanical principles, induces me to suggest to you that the traction of a carriage is independent of the friction between the tire and the road, and is due to the friction between the wheel and the axle, and to what may be called the resistance to rolling at the circumference of the wheel, which resistance is in no way analogous to friction, but is, in fact, equivalent upon a good hard road to the working power expended, and therefore for all useful purposes lost, in producing the vibrations in the road, which are sufficiently manifest when a heavy wagon is passing.

When springs are attached to a carriage, the power thus absorbed is diminished, and hence the facts recorded in the first article of your last number

(1233) are such as correct mechanical principles would lead us to anticipate. I am aware that the resistance to rolling has by some writers on mechanics been improperly denominated friction, and thus you appear to have been led into error. However, I hope this may have some influence in leading you to see that "refinement of language" has something to do with "refinement of science."

I am, Sir, yours, &c.,

J. F. HEATHER.

Royal Military Academy,
March 29, 1847.

[No doubt this "retort courteous" is intended to show that the author of the new "Treatise on Mechanics" does after all know more of the marrow of his subject than we gave him credit for (p. 224); but more conclusive evidence that we were right in our estimate of his capacity and attainments we could not, even with unfriendly purpose, have desired to see. It may not be strictly correct to call resistance to rolling, *friction*—for there is the resistance of the *vis inertiæ* to be taken into account; but this, at least, can be said for the phrase, that it is such as neither leaves the mind in any doubt of what is meant, nor conveys any impression at variance with truth. Can as much be said for the language of Mr. Heather? He asserts, that "the traction of a carriage is independent of the friction between the tire and the road"—which all the world knows to be just as certainly contrary to fact, as that rough and smooth are the same thing; and then he tells us that it (*i.e.* the resistance) is "in fact equivalent upon a good hard road to the working power expended," which leaves the question as to what that power is expended upon, as unexplained (for him) as ever. Mr. Heather has evidently much both to learn and unlearn before the principles of mechanics can derive any elucidation at his hands. In the learning way, before all else—modesty; in the unlearning—that college pride, or priggism, which delights in intellectual subtleties, regardless alike of practical utility and of common sense. While boasting of being able "to show that considerable improvements can be made upon *the manner* in which this subject has been handled by *even its greatest masters*," he shows but too clearly that his acquaintance with the *matter* of it is scarcely on a par with that of even its humblest servitors. "Late scholar of St. Peter's College, Cambridge", the next best thing Mr. Heather could do would be to avail himself of his present position (Mr. Heather describes himself as now "of the Royal Military Academy, Woolwich,") to obtain at the neighbouring museum or workshops, some practical knowledge of what such things as friction, and resistance, and wheels, and axles, &c., really are.—ED. M.M.]

THE GUN-COTTON.—M. SCHONBEIN'S SPECIFICATION.

The specification of this patent (taken out in the name of Mr. John Taylor, of the Adelphi,) became due and was inrolled yesterday. The following is a correct abstract of its contents:

The patentee states that the invention consists in the manufacture of explosive compounds applicable to mining purposes and to projectiles, and as substitutes for gunpowder, by treating and combining matters of vegetable origin with nitric and sulphuric acids.

The matter of vegetable origin which he prefers, as being best suited for the purposes of the invention, is cotton, as it comes into this country, freed from extraneous matters; and it is stated to be desirable to operate on the clean fibres of the cotton in a dry state.

The acids are, nitric acid of from 1·45 to 1·50 specific gravity, and sulphuric acid of 1·85 specific gravity.

The acids are mixed together in the proportion of 1 measure of nitric acid to 3 measures of sulphuric acid, in any suitable or convenient vessel not liable to be affected by the acids. A great degree of heat being generated by the mixture, it is left to cool until its temperature falls to 60 or 50 degrees Fah. The cotton is then immersed in it, and, in order that it may become thoroughly impregnated or saturated with the acids, it is stirred with a rod of glass or other material not affected by the acids. The cotton should be introduced in as open a state as practicable. The acids are then poured or drawn off, and the cotton gently pressed by a presser of glazed earthenware, to press out the acids, after which it is covered up in the vessel, and allowed to stand for about an hour. It is subsequently washed in a

ontinuous flow of water, until the presence of the acids is not indicated by the ordinary test of litmus paper. To remove any uncombined portions of the acids which may remain after the cleansing process, the patentee dips the cotton in a weak solution of carbonate of potash, composed of 1 ounce of carbonate of potash to 1 gallon of water, and partially dries it by pressing, as before. The cotton is then highly explosive, and may be used in that state; but, to increase its explosive power, it is dipped in a weak solution of nitrate of potash, and, lastly, dried in a room heated by hot air or steam to about 150 degrees Fah.

It is considered probable that the use of the solutions of carbonate of potash and nitrate of potash may be dispensed with, although actual experience does not warrant such an omission.

The patentee remarks, that nitric acid may be employed alone in the manufacture of explosive compounds, but that, as far as his experience goes, the article when so manufactured is not so good, and far more costly.

When used, care should be taken to employ a much less quantity by weight, to produce the same result, than of gunpowder; and it has been found that three parts by weight of the cotton produce the same effect as eight parts by weight of the Tower-proof gunpowder.

The cotton, when prepared in the manner before mentioned, may be rammed into a piece of ordnance, a fowling-piece, or musket; or may be made up into the shape of cartridges; or may be pressed, when damp, into moulds of the form of the bore of the piece of ordnance for which it is intended, so that, when dried, it shall retain the required figure; and it may also be placed in caps, like percussion caps, and made to explode by impact. Lastly, the patentee states, that although he prefers the use of cotton, other matters of vegetable origin may be similarly treated with acids to form an explosive compound, and that acids of an inferior specific gravity may be employed.

The patentee having thus described the nature of the invention, and in what manner the same is to be performed, states, that he does not confine himself to any of the details above specified, so long as the peculiar character of the invention is retained, viz., the manufacture of explosive compounds from matters of vegetable origin by means of acids. But, to adopt the patentee's own expression, "What I claim is, the manufacture of explosive compounds from matters of vegetable origin, by means of nitric acid, or nitric and sulphuric acids."

NOTES AND NOTICES.

Lord Dundonald's Projectile.—We understand that the secret official trial to ascertain the effect of a continuous evolution of intense gas in projecting shells or shot from a tube, resulted on an average in throwing 25 6-pounder shot to the distance of 7000 yards. From this data it is clear that balls of greater diameter would far exceed the range of common artillery. Another important advantage is said to accrue—namely, that the continuous rush during their emission would prove much less injurious to vessels projecting such missiles than the shock or recoil of single discharges. We learn that Lord Dundonald's ingredients produce an elastic emission, like that which would be evolved by kindling the end of a hawser or cable formed of hard-twisted gun-cotton.—*Hampshire Telegraph.*

Neptune's Ring.—Mr. Lassel, of the Liverpool Observatory, and Professor Challis, of Cambridge, have ascertained that the new planet is surrounded, like Saturn, by a ring, situated with its plane very obl que to the direction of vision.

Gutta Percha.—We observe from the French journals that our neighbours are, after their usual fashion, getting up a claim to the first introduction of this valuable material into Europe. It is said to be one of the "heureux resultats" of the French expedition to China. If they will consult their own registry of brevets, they will find that the use of it was patented in France by an Englishman, (Mr. Nickels,) before anything was heard of their Chinese expedition.

Clarke and Varley's Resilient Atmospheric Railway.—A trial of this ingenious system, of which we gave a full account in our journal vol. xlv., pp. 49 and 108, is about to be made on the Blackwall Railway. A pair of large and highly-finished air-pumps are already fixed in the engine-house of the railway, to be worked by the large Blackwall engine; the rails are laid, and the greater portion of the tube is fixed.

The Planet Neptune.—Mr. Struve, in a letter to Professor Challis, says:—"The Palkova astronomers have resolved to maintain the name of Neptune, being of opinion that the name of Leverrier would be against the accepted analogy, and *against historical truth, as it cannot be denied that Mr, Adams has been the first theoretical discoverer of that body*, though not so happy as to effect a direct result of his indications."

Another Claimant to the Discovery of Neptune.—Lieut. Maury, in a letter to the *Union*, U. S., announces the very probable discovery, that the new planet, Le Verrier, was observed as a fixed star by Lalande, in 1795."

The Trees most Affected by Lightning.—Fig trees and cedars are rarely struck with lightning; the beech, larch-fir, and chesnut, are obnoxious to it; but the trees which attract it most are the oak, yew, and Lombardy poplar; whence it follows that the last are the trees most proper to be placed near a building, since they will act as so many lightning conductors to it. Again, the electric fluid attacks in preference such trees as are verging to decay by reason of age or disease.

Influence of Sunshine.—Mr. R. Hunt has conclusively established by an exclusive series of experiments that precipitation takes place in all metallic solutions more rapidly in the light than in the dark—all other circumstances being the same. The luminous rays appear, however, to have nothing to do with the change. The precipitation is as much suspended while under the full influence of the yellow ray as an absolute darkness, but within, and even beyond the dimly lighted end of the spectra, the precipitation is very rapid.

Mr. Warner's Long Range.—A long correspondence has been published in the daily papers between Mr. Warner and Lord John Russell relative to the invention of the former Mr. Warner complains that the spot chosen by the commissioners for this

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experiment was a most unfavourable one, being a bowl of swampy land, and that the wind and weather were against him. He repeats his firm conviction that his inventions possess all the merits he has always ascribed to them, and offers to repeat the experiments at any time Lord John Russell may appoint. Lord John Russell informs Mr. Warner that her Majesty's Government do not think it necessary to make any further experiments to test the value of his inventions. Finally, Mr. Warner offers to appeal from the decision of the Government to the public. "I am now prepared," he says, "to try the efficacy of the long range in the face of my country—that country to consist of members of parliament, men of science, and accredited delegates from the leading public journals."

American Steam Navy Contracts.—Congress, during the last session, gave authority for building and hiring the following steam ships:—Four for the navy; an indefinite number for a mail line, under contract with E. K. Collins, of New York, to run between New York and Liverpool; another line, under contract with A. G. Sloo, of Cincinnati, to run between New York and New Orleans, touching at Charleston, Savannah and Havana, and extending to Chagres; and another line is to be contracted for by the Secretary of the Navy, to run from Panama to Oregon, so as to connect with the line from Havana to Chagres. All these lines are to be semi-monthly, each vessel to be 1500 tons burthen, 1000 horses power engines, except on the line from Havana to Chagres, where a small class of steamers, not less than 600 tons burden, may be employed. All the vessels are to be subject to the control of the government, convertible into war steamers at pleasure. Each shall have four midshipmen and one post-office agent on board, free of charge to government. The Navy Department is to superintend the construction of the mail steamships. Mr. Sloo is to have 280,000 dollars per annum, and 500,000 dollars is to be advanced by government for the construction of vessels for his line. The contract with Mr. Collins is accepted on the terms offered in his proposals. The contract for the Panama and Oregon line is left altogether to the discretion of the secretary, who may employ sailing vessels, if deemed advisable. One million is granted for the four vessels for the navy.

LIST OF ENGLISH PATENTS GRANTED FROM APRIL 1, TO APRIL 8, 1847.

William Phillips Parker, of Lime-street, gentleman, for an improved mode of manufacturing cigars. (Being a communication.) April 1; two months.

Benjamin Tucker Stratton, of Bristol, agricultural machinist, for improvements in railways, and in wheels and other parts of carriages for railways and common roads, partly applicable in the construction of ships or other vessels, and improvements in the machinery for manufacturing certain parts of the same. April 6; six months.

Charles De Bergue, of Arthur-street West, London, and John Coope Haddan, of Upper Woburn-place, civil engineer, for improvements in wheeled carriages, and in panels and springs for carriages and other purposes. April 8; six months.

David Napier, of Glenhellish Strachen, Argylshire, for improvements in steam-engines and steam vessels. April 8; six months.

Stephen Moulton, of Norfolk-street, Strand, gentleman, for improvements in the construction of bridges. April 8; six months.

William Tharpe Stevenson, of Upper Baker-street, Loyd-square, gentleman, for improvements in regulating the generating of steam in steam boilers. April 8; six months.

Patrick Moir Crane, of Yuiscedwyn Iron Works, near Swansea, for improvements in the manufacture of iron. April 8; six months.

Patent Carriages.

MESSRS. WHITEHURST and Co., have secured a license from Mr. Thompson, (the Patentee of the "AERIAL WHEELS,") to fit them to every description of carriage. These wheels give carriages a gentleness of motion quite unattainable by any kind of springs whatever. They entirely prevent the carriage making any noise; they prevent all jarring and jolting, and the draught is considerably less than common wheels, particularly on bad roads. Messrs. Whitehurst and Co. have fitted up a brougham with the "Aerial Wheels," in order that gentlemen desirous of trying them may have an opportunity of doing so.—313, Oxford-street, near Hanover-square.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

The Gutta Percha Company

INVITE the attention of Engineers, Machinists, Mill Owners, &c., to the PATENT GUTTA PERCHA DRIVING BANDS, which possess the valuable properties of great durability and strength, permanent elasticity, and uniformity of substance and thickness, thus avoiding all the irregularity of motion occasioned by piecings and inequality of thickness on leather straps. They are not affected by fixed Oils, Grease, Acids, Alkalies, Water, &c., and possess extraordinary facilities for being joined, and hug their work in a remarkable manner. Can be had of any width, substance, or length, without joints.

The Company continue to receive most satisfactory Testimonials of the superior quality of these Bands, which can be seen at the Company's Works Wharf-road, City-road, where all orders will receive immediate attention.

E. GRANVILLE, Manager.

London, March 3, 1847.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1236.] SATURDAY, APRIL 17. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

OSBORNE'S IMPROVEMENTS IN BRIDGE-BUILDING, ROOFING, AND FLOORING.

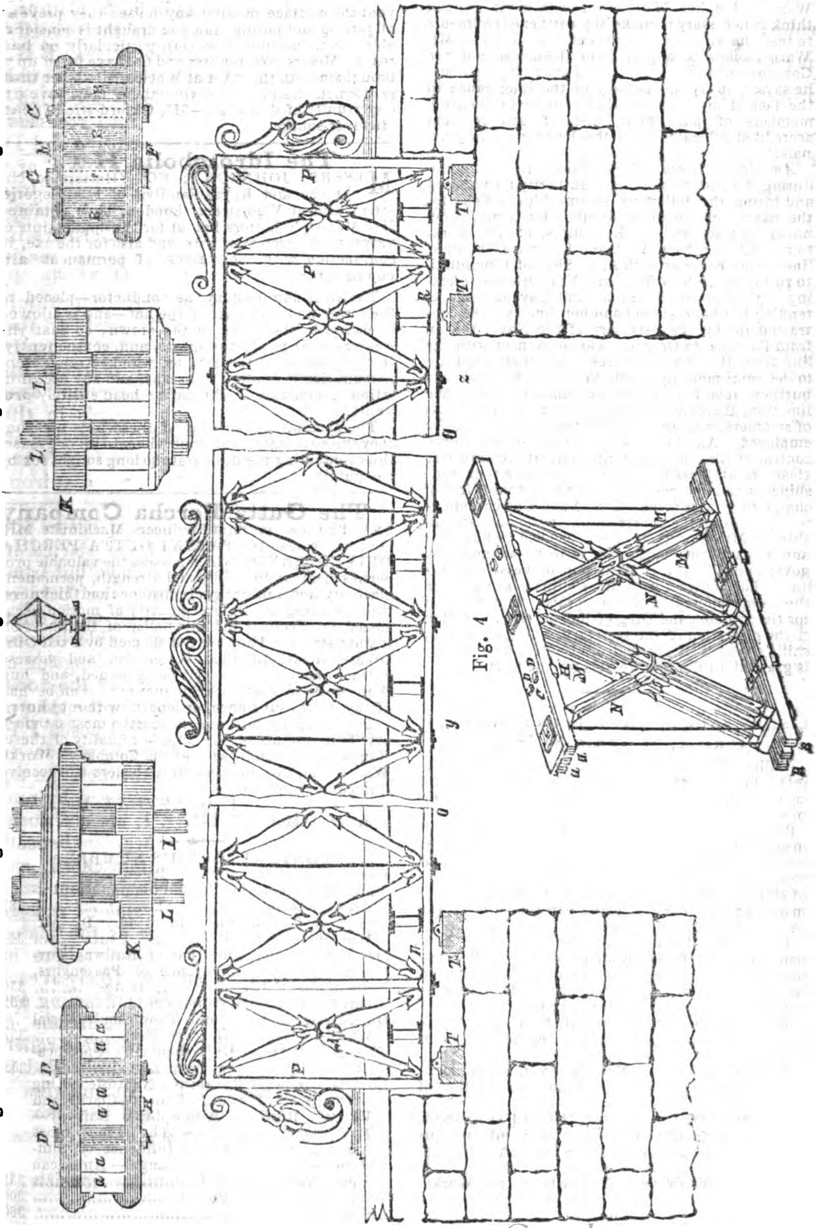
Fig. 2*a*.

Fig. 3*a*.

Fig. 1.

Fig. 3.

Fig. 2.



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OSBORNE'S PATENT IMPROVEMENTS IN BRIDGES, ROOFING, AND FLOORING.

[Patent (for Ireland) dated June 22, 1845; Specification enrolled December 22, 1846.]

The improvements which form the subject of this patent are stated to have been partly communicated to and partly invented by the patentee, Richard Boyse Osborne, Esq., C.E., Engineer of the Cork and Limerick Railway.

The *first* and most important of them consists in substituting for the solid beams ordinarily used in the construction of iron bridges and other iron structures, which are of large span between their piers or other points of support, *frame beams* of numerous pieces, combined or trussed together in such a manner that the direct transverse strain to which solid beams are subjected is resolved into a series of tensile, and compressing, or acting, and counteracting forces, and which frame-beams may be made of greater length and strength than solid beams, and raised into their places with more facility, whereby a large saving of material and labour will be effected. Fig. 1 represents a side elevation of a frame beam of this improved description, 95 feet long. Fig. 2 and fig. 2*a* are cross sections of the top and bottom chords of the beam on the lines *y y*; and fig. 3 and 3*a* cross sections of the same on the line *z z*. Fig. 4 is a view in isometrical projection of the two central panels or divisions of the beam. In the section of the top chord, fig. 2, *a a*, *a a*, *a a*, are plates of wrought iron laid longitudinally on their edges; C a cast-iron cap-piece which covers the plates, *a a*; H a clamp of wrought-iron which supports the plates from beneath, and D D bolts (with nuts and washers) by which the cap-piece, C, and under-clamp, H, are bound together (with the plates *a a* between them), and which bolts serve at the same time to separate these plates into pairs, and to keep them at equal distances apart. In the section of the bottom chord, fig. 2*a*, B B, B B, B B, are plates of wrought iron similar to *a a*, and laid also on their edges, which are secured in their places by wrought-iron clamps, E F, at top and bottom (there being in this case no cap-piece), and bolts G G (with nuts and washers) passed through both clamps, which bolts serve also, as in the preceding case, to separate the plates, B B, into pairs, and to keep them at equal distances apart. K K, fig. 3, are triangular iron blocks inserted into recesses cut out crosswise in the plates *a* and B of the top and bottom chords. L L are vertical tie-rods which connect the top and bottom chords, and which, being passed intermediately through orifices in the blocks, K K, serve also to make these blocks fast. M, M, M, M, fig. 4, are diagonal braces of cast iron which abut at top and bottom against the blocks, K K, and are started in pairs from each end, one half of them inclining inwards in one direction, and the other half inclining inwards in the opposite direction, and both meeting in the centre, as shown in fig. 4. N N are single diagonal braces of cast iron, which abut at top and bottom against the blocks, K K, and pass between the double braces, M M, and are started in two series, not from the ends, but from the centre of the beam; the bars of each series being inclined in a direction contrary to that of the double braces, between which they pass. Alongside of each of the two last pairs of the rods, L L. There are inserted, for the sake of greater security, two vertical posts, P P, (one of each pair only being seen in fig. 1) which are passed through the top and bottom chords, and secured by nuts and washers. P P, fig. 1, are end posts, and O O, flat bearing-plates, laid beneath the two ends of the bottom chord, and secured by passing through them such of the bolts, D and G, and tie rods L, as come within the range of the plates. R R, fig. 1, are two plain rollers on which the frame-beam rests freely at each end, so as to allow of its contracting and expanding according to variations of temperature. The axes of these rollers turn in boxes, which are imbedded in wooden bearings, T T. An end view of one of these rollers and its box is given separately on an enlarged scale in fig. 5.

Secondly, the invention consists in

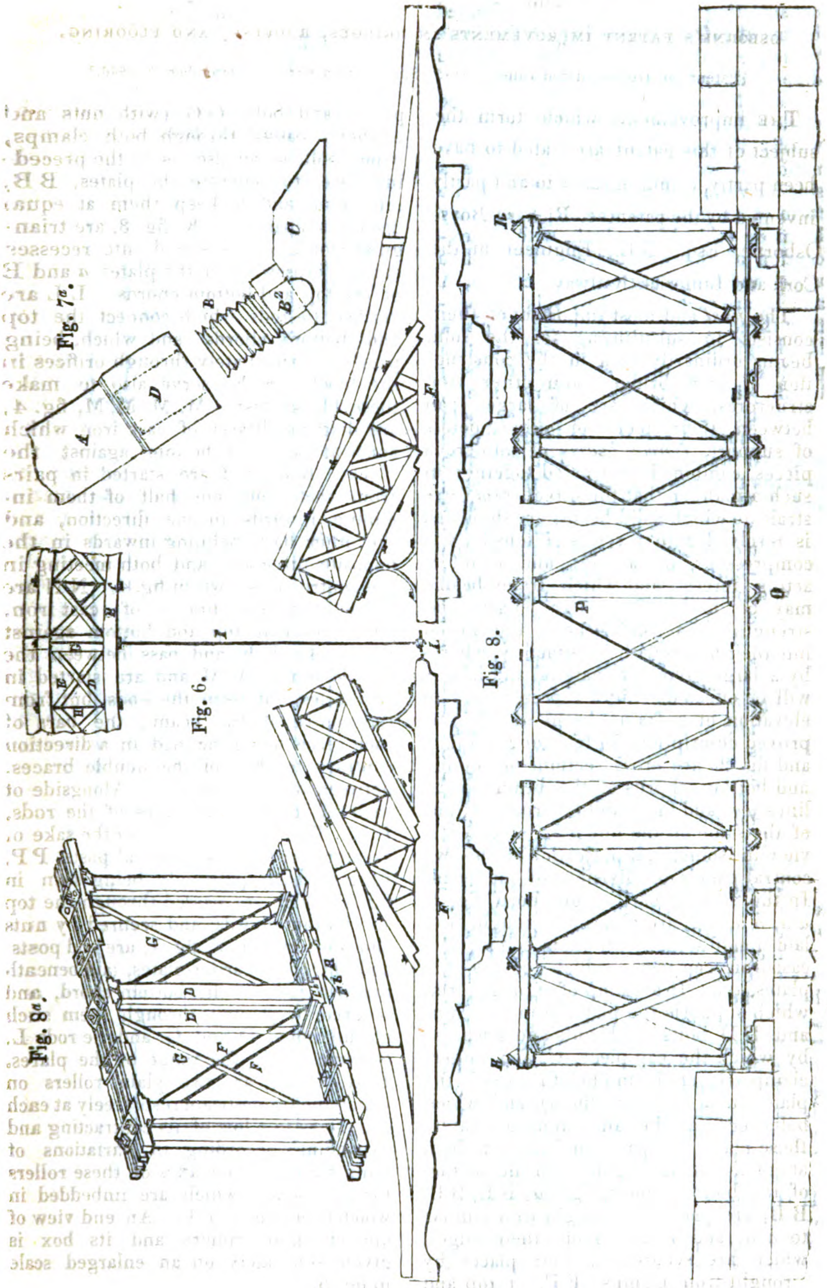


Fig. 7a.

Fig. 6.

Fig. 8.

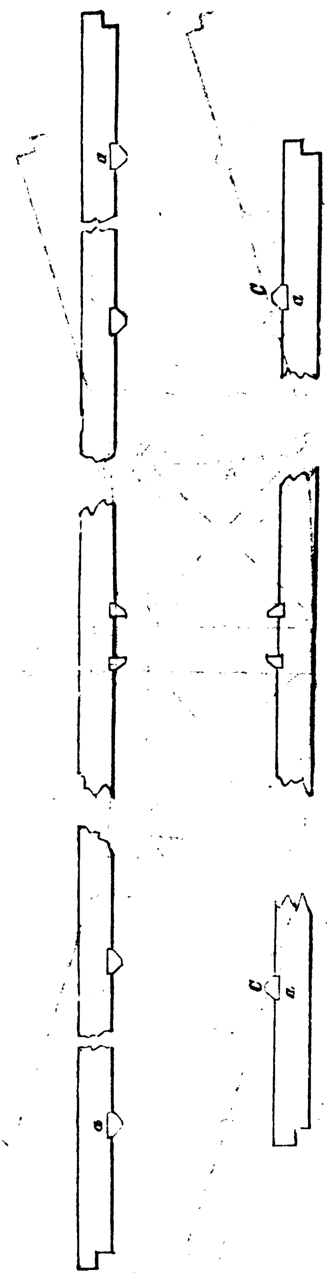
Fig. 8a.

constructing iron and wooden-framed beams of rafters for roofing, on the same principle as the beams for bridges before described, and in a similar manner.

Such frame beams or rafters may be made either curved or straight, and either wholly of wood or iron, or of a combination of wood and iron. Fig. 6, is a side elevation of a frame rafter of the form of a segment of a circle, which may be made entirely of plank, with the exception of the wall-bearers, F F. The upper and lower segments or chords, A and B, are each formed by spiking together three or more thicknesses of plank laid longitudinally, and in such relative positions that they shall everywhere break joint. C C are abutting blocks, which are let into recesses cut for them in the chords A and B. D D are double diagonal braces, all inclined at each side towards the crown or centre of the beam; and E E, single diagonal, or counter braces, which pass between and are inclined in directions contrary to the double braces—both sets of braces abutting at top and bottom against the blocks C C. G G are two centre posts, (one only seen in the engraving.) H H are vertical tie-bolts, which are passed through the top and bottom chords, and also through the abutting blocks C C, and are nutted on washers of cast iron. I is a long rod, which is passed down between the two centre-posts G G, and through both chords, and enters into an eye in the horizontal tie-rod K. L is a screw-nut, by which the rod I is adjusted to any degree of tension required.

Thirdly, the invention consists in certain modes of curving or cambering frame-beams constructed as before described, and keeping them, after erection, of any given curve or camber, or preventing them, when made straight, from swagging. One mode of producing any required degree of camber while in the course of construction is represented in figs. 7^1, 7^2, and 7^3. After the planks or plates of each segment or chord have been spiked or bolted together, the patentee marks out thereon the points (say *a*, *a*, *a*,) at which the different tie-bolts (H H) ought to be introduced in order to suit the radii of the required curve. The triangular abutting blocks, C C, are then set in their places, the segments or chords remaining the while perfectly straight, as at first framed, (see fig. 7^1.)

Fig. 7^1.



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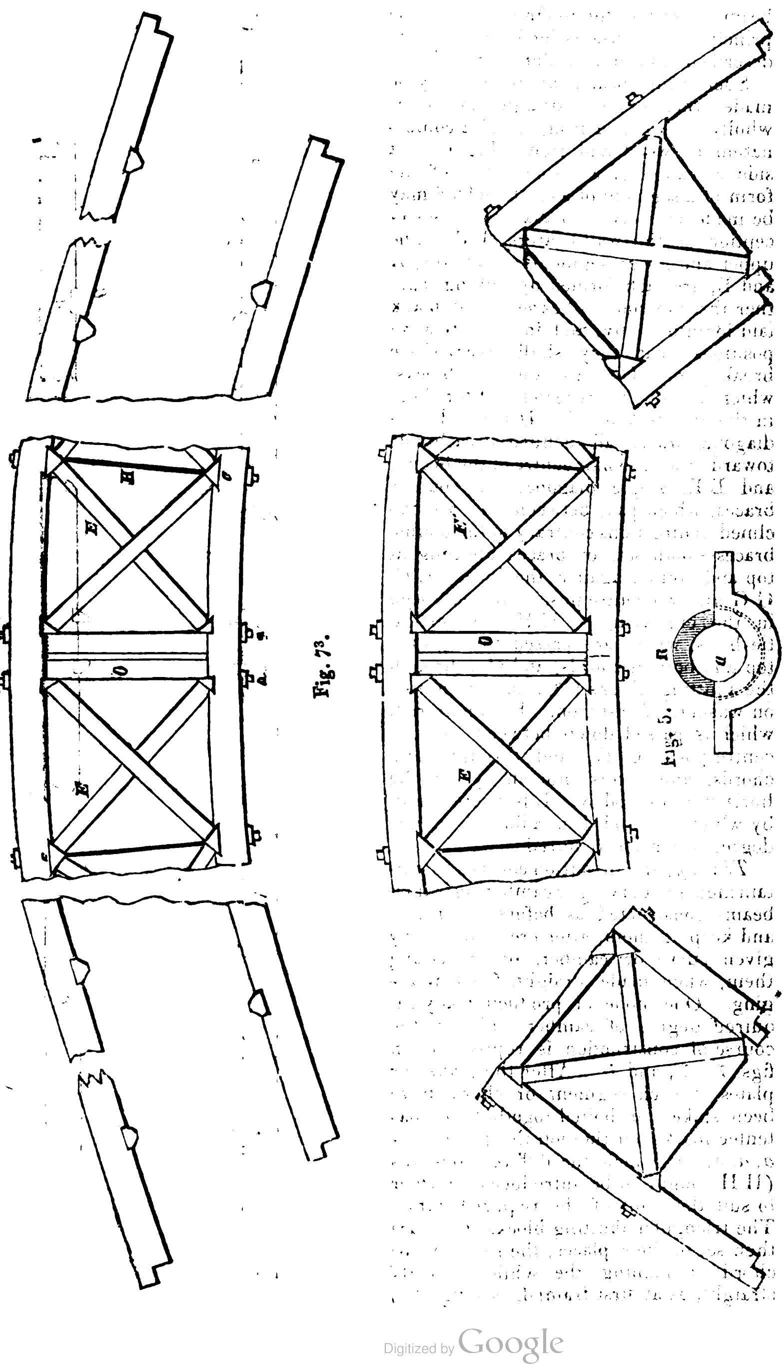

Fig. 72.

Fig. 73.

Fig. 5.

The centre-posts, O O, are then inserted, (see fig. 7^2,) and next a few sets of the braces onb oth sides of the centre. A tie-bolt, H, for each set so inserted, is then put in, and screwed up to such a degree of tightness as may suffice to keep the first sets of braces in their places, and yet leave room enough for introducing with ease the remaining sets. When a number of sets or panels have been thus adjusted, the two or three nearest the centre on each side are farther tightened up by the tie-bolts H H, until the main and counter braces abut closely on their respective blocks, which brings them to the exact curve or camber required, and causes the beam to assume the appearance represented in fig. 7^2. The same course is pursued till the whole of the braces and the bolts are inserted and screwed up, when the beam exhibits the perfect form represented in fig. 7^3. In forming centring for stone bridges over deep and rapid waters, this will be found a very simple, efficient, and economical mode of construction.

Another mode of cambering consists in making all the divisional spaces alike while putting the framing together, and then lengthening the centre or single diagonal braces (E E) on each side of the centre in a ratio corresponding to the degree of the curve.

The mode which the patentee adopts to cause the frames, after construction, to retain the forms given to them, is represented in fig. 7^4; but it may be proper to observe that this is a mode chiefly adapted to straight or slightly cambered beams. The foot of each counter or single diagonal brace is furnished with a female screw, D, and male screw, B, as shown; and the male screw is inverted, so as to allow the head of it to rest in a recess or socket made for it in the abutting block C, with which it forms a joint resembling the ordinary ball and socket joint. The brace can then be tightened at any time by applying a common wrench to the nut B^2.

Fourthly, the invention consists in constructing, on the suspension principle, rigid frame-beams for bridges, floors, and other like structures. Fig. 9, represents a side elevation of a frame-beam on this plan, and fig. 8^a an isometrical projection of a portion of the same.

A and B are top and bottom chords, each formed of iron plates, or of wood of proper scantling, bolted and clamped together at intervals, as shown. C^a C^b are flat rectangular blocks, let into recesses cut for them in the chords A and B. D D are vertical posts, which rest at bottom on the blocks C_b, and support at top the blocks C^a. E^a E^b are triangular blocks fitted into seats cut out for them on the upper side of the chord A, and under side of the chord B. F F are diagonal suspension rods, which are passed from the top through the blocks E^a and C^a down to and through the blocks C^b and E^b, and are started in pairs from the heads of the posts R R, at each end of the beam, and all inclined inwards towards the centre of the beam, so that one half of them are necessarily inclined in a direction opposite to the other half, till they meet in the centre at O. G G are single diagonal suspension rods, which are started from each side of the head of the centre-post P, in directions opposite to the double suspension rods F F, (passing through between them,) and are passed in like manner through the blocks E^a and C^a, C^b and E^b. Both sets of suspension rods (F and G) are fitted at top and bottom with heads, nuts, and washers, so that they may be screwed up till any degree of rigidity is obtained, and the whole of the parts of the structure be then firmly bound together.

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

(Continued from page 326.)

With regard to the existing treatises on mechanics, it is almost impossible to select any *one* which can be said to be the best adapted to the beginner. They all exhibit the great and fatal deficiency of examples, without which every book —no matter by whom written—*must be unsuited* to the purposes of self-instruction. To make the matter still worse, there is no collection of easy problems on the subject, published separately, that I am aware of. Such being the case, the student must pick out here and there—at a great expense of time and money—that which it is the usual province of a private tutor in the various universities to supply—viz., illustrative examples worked out, and general hints as to the way of going to

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work. The student, if acquainted with French, (and every one who intends to acquire an extensive knowledge of mathematics, or, indeed, of any science, will find an acquaintance with the French language indispensable—*i. e.*, so far as to be able to read scientific works, for which purpose a very slight familiarity will go a great way—such as most persons have learnt at school, or may pick up in six months,)—if acquainted with French, I say, cannot, perhaps, do better than take Poinsot's "Statique" as a text-book. It is the standard work on the elementary branches of the subject in France, and as being the production of one of the greatest mathematicians of the day—of a man who has probably *thought more* about the principles of the science than any other—it holds a rank to which perhaps no other work (except Poisson's) can lay claim. Some very valuable memoirs on dynamical subjects are attached as a sort of appendix, which will be appreciated after some years' experience and knowledge of dynamical subjects, but probably not before. Poisson's two volumes, *of course*, form an indispensable book of reference to those who go at all beyond the elements, and even in the elementary branches they are useful to those who have got some knowledge of the matter from other sources; but it is not a book for the beginner. There are a multitude of elementary compilations by French authors, few of which being known in England, or likely to be met with by the English reader, it is unnecessary to notice them. Francœur's "Mécanique" might perhaps be useful now and then, and is said to have been written under the direction of Laplace. Bossut's work on this subject, forming the third volume of his "Cours de Mathématiques," is an original work, and by a man who held a high place amongst the mathematicians of his time. The subject of arches, roofs, &c., is very fully treated in the later editions, (1802), and the whole book likely to please those who dislike *formulæ;* but is not adapted to the modern method of solving mechanical problems. Preny's "Leçons de Mécanique Analytique" is also the work of a very eminent mathematician, and perhaps the earliest of those which established the present elegant form of the science, after Lagrange. The elementary portions, both of mechanics and hydrostatics, are also treated very fully in the first volume of the "Architecture Hydraulique," by the same author, which, however, is not at all a likely book to fall into the hands of many English students. Within the last two years, M. Duhamel has published his "Cours de Mécanique de l'Ecole Polytechnique," in two volumes; but though several parts are of great value to the advanced student, the work is not at all a fit one for a beginner. Of all the recent French works on this subject, with which I am acquainted, the best adapted for those who are entering, for the first time, on it, and whose principal object is to apply practically their acquisitions, is the well-known work of Poncelet, called "Mécanique Industrielle." This contains the substance of what was delivered as a course of lectures to workmen at Metz. This is in 2 vols., 8vo. There is another work, entitled, "Introduction à la Mécanique industrielle, physique et expérimentale," 1 vol., 1839, by the same author, which I have not seen. Another very clear and well-written work, with a somewhat similar object, is the "Traité de Mécanique," of M. Bresson, 1 vol., 4to. The author professes in his preface to have written it expressly for the use of practical men, and to have had extensive experience of their wants. So far as the general method of reasoning, and absence of analytical calculation goes, it seems to be what it professes. Indeed, those parts which I have read are done more clearly and copiously than the corresponding parts of any other book that I know of. Its price, however, will necessarily be a great drawback from its circulation amongst those for whom, according to the author, it is intended; for very few will be willing to lay out a pound in one volume, which only treats, after all, of a small portion of the whole subject. Lastly, must be mentioned a work recently published, by M. Taffé, the object of which is to calculate numerically, for the different sorts of machines, the relation between the power applied and the work done, according to theoretical principles contained in the works of Poncelet, &c. I do not recollect the exact title of the book, which, however, may be easily ascertained at Baillière's, in Regent-street, or any other importer of French scientific books.

Of English works I shall only mention

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what appear to me the respective characters of those with which I am acquainted, and from which the student is most likely to make his selection. Whewell's works on *dynamics* are excellent, and fully deserve the reputation which they have procured to the author: from some cause or other they have fallen into partial neglect, which would not be the case if their real merit were as generally known as it ought to be. It will be understood that they are chiefly written with a view to their application to astronomy, and therefore are not at all suited to the wants of the engineer, even if he possessed sufficient knowledge of the differential and integral calculus to be able to comprehend them. This, indeed, may be said of all the treatises on dynamics written for university students, as might be expected. With respect to Whewell's "Mechanics," by far the best known of his works, it is already in the hands of so many persons as to render any remarks almost unnecessary. The great blemish of the statical part—that which entirely destroys the *philosophical nature* of the book—is the founding the whole science on the properties of the lever instead of on the parallelogram of forces.

The clumsiness, and utterly unsatisfactory nature of such a method, is too obvious to need any remark. The Master of Trinity has got some queer crotchets on this subject of "the foundations of mechanics," in which he is totally at variance with all the great French writers, and which have, unfortunately, spoiled his book as a *scientific treatise.* The other great defect appears to me to be the chapter on impact and collision, in the dynamical part of the treatise. This is done in a way which will satisfy very few persons except the author, I imagine. If the student, however, begins with "Duchayla's Proof of the Parallelogram of Forces," (or any other which may be satisfactory to him,) cuts out all the long bungling chapter on the lever, (except the fundamental property, which may be deduced from the parallelogram of forces in half a dozen lines,) and also substitutes some other book for the chapter on collision, &c., he will find the rest of the work to constitute altogether one of the best courses of reading that he could meet with. The work on "Analytical Statics" requires a knowledge of the differential and integral calculus.

Earnshaw's "Statics" and "Dynamics" are both very excellent works, not compiled from others, but the production of one who is one of the best authorities we have on dynamical questions. There are also a few tolerably easy problems worked out both in the "Statics" and "Dynamics"—more than in any other book that I know of, but still not enough of the "easy" ones. But the same remark applies to these as to other academical works—they are not *adapted to engineers*, though engineers may derive a thorough knowledge of first principles from them. "Pratt's Mathematical Principles of Mechanical Philosophy" is a work so exclusively adapted to university reading, that three-fourths of it would be useless to the engineer; but for the *elegance* of its demonstrations and the "neatness" with which everything is done, it is unequalled. To those who intend to read physical astronomy, it cannot be too highly recommended. Snowball's "Mechanics" is a book of which the less said the better. One wonders why it was ever written. The only explanation is, that, at the time it appeared, Dr. Whewell's *fifth* edition of his "Mechanics" being out of print, a sixth was published, in which, so far from *improving* and extending, the author had completely mutilated his own former editions—so much so, that if Dr. Whewell's name had not still appeared on the title-page, the natural supposition would be, that "an enemy hath done this."

Professor Lloyd of Dublin, published in 1826 a very valuable treatise on "Mechanical Philosophy," of which only the 1st vol. ever appeared, and is now rarely to be met with. Those portions of the "Mechanical Philosophy" of Professor Robison of Edinburgh, which relate to mechanics and hydrostatics, are of a more *useful* tendency than perhaps any other that could be named, except the works of Barlow and Hodgkinson on the strength of materials; but not only are the 4 vols. which contain Robison's articles very expensive and difficult to procure, but they require the possession of some previous information derived from systematic treatises. One cannot but remark, by the way, that the number of really valuable scientific works "out of print," and not to be had either for love or money, is a disgrace to our scientific literature. Whilst quack advertisements and reviews

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written after half an hour's casual inspection of a book, by one perhaps who "does the reviewing" on all subjects, from astronomy to dancing—whilst such puffery in the provincial newspapers, and impudent self-laudation in *all* papers, is cheating a deluded reader out of his money for the most trashy and ephemeral rubbish—the great standard works of men who have devoted their lives to a subject, and only published what cost them years of intense thought, are allowed to sink into oblivion—the only chance afforded to those who know their value of meeting with them, being at some old book-stall for a few pence, or by specially commissioning a bookseller to buy them *at any price*.

To return to the elementary treatises. Bridge's Mechanics contains several problems with their solutions, which would be useful: the rest of the work being written in the old style, this renders it of little use to those who wish to read modern works afterwards. There are also 2 vols. by Venturoli, translated by Cresswell, which I believe contain several inaccuracies, and even gross blunders —*otherwise* some good might be got out of them. Mr. Tate's unassuming little work has been too recently noticed in this Magazine to render any further recommendation requisite: the same may be said of Professor Moseley's large work, which, however valuable to the *mathematical* student and *amateur* of engineering science, will, I fear, be found but little calculated to assist practical men. The labours and writings of Professor Barlow and Mr. Hodgkinson are far too well known, and I doubt not appreciated, by the engineering body, to render any notice of them requisite. Their investigations, however, require a previous acquaintance with the general principles of mechanics, and therefore would be unintelligible to those who attempted to read them without such preparation.

Perhaps, on the whole, the following works taken together, may be the best that the beginner could commence with: "Earnshaw's Statics," the fifth edition of "Whewell's Mechanics," and for practical application, Mr. Tate's "Exercises." And, especially, if he can read French, Poinsot's "Statique."

We come now to what is of much more importance than the books—*how to read them*; or rather how to acquire a knowledge of the science. Of all the "vulgar errors" which exist, there is none which requires exposing more than the notion under which nearly every student labours at the beginning of the different sciences which he learns, that the obscurity and difficulty he feels are the fault of this or that book—and the fancy that if he could only meet with such a book as *ought* to be written, he should forthwith become all of a sudden illuminated. Being possessed of this hallucination, he tumbles over the leaves of the works which he has, and scrapes together with the most ludicrous eagerness all sorts and conditions of books—very greatly to the benefit of booksellers, and very much to his own discomfiture. Not one whit the wiser does he become for all this medley. All is vanity and vexation of spirit. Having abused the authors of the whole lot, as the perpetrators of unintelligible mystecisms—who with malice aforethought did knowingly and artfully write a book for the especial botheration and torment of himself and all other readers whatsoever, he next bethinks himself of abusing his own stupidity and "want of brains." I believe it would be found, if a statistical account were made up—that some thousands of young gentlemen have, one after the other in their day and generation, arrived after mature deliberation at the very satisfactory conclusion that no one was so pestered, so bothered, so thick-headed, so "not-born-for-a-mathematician" as themselves. At the commencement of algebra he is very certain that he shall never understand anything about it. When that is somehow or other got over, he is positive that plane trigonometry is of that peculiar nature that *he* shall never comprehend it—and so on. Now, there is some mischief—more than is perhaps often thought of, done by this pusillanimity; for a habit is got into of *expecting to find a great many things in mathematics which ordinary common sense cannot master*. A great many propositions they consider to be "proved" by a "sort of juggling," which for want of any other proof they are content to admit: the original impression of the unsatisfactory nature of the "proof" gradually wears away, and thus there are in the "creed" of many (who possess what is generally considered an extensive knowledge of mathematics) no small number of theorems, and those too,

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sometimes, of vital importance, which have been *received on trust*, more than admitted on evidence, and of which, if called upon, they could offer no rational demonstration. One instance to show my meaning will be enough. How many of those who consider themselves tolerably good mathematicians are there who have not received as proof of the principle of "indeterminate co-efficients," the one line and a half which modestly requests you to "let $k=0$," and then comes down upon you with it.—Q. E. D.?

Let this be taken then as the *very first and most vitally important principle,—that no proposition in mathematical works is to be received, and* CONSIDERED AS PROVED, *unless each step is distinctly seen to consist of what is generally termed—good common sense reasoning.* It may appear very unnecessary to insist on such a point, but those who know anything of the capacity of swallow with which many students are endowed, will not think it at all unnecessary.

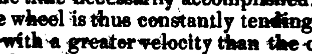
There is, and can be, BUT ONE kind of reasoning; and those who talk of *mathemathical reasoning* being of a different nature from other kinds of reasoning, *confuse* "reasoning" with the *results* of that "reasoning." A man may make the most absurd hypothesis imaginable, but reason it out as naturally as Euclid does any of his propositions. But that which gives to mathematics its superiority, is the clear conception of the subject reasoned about—which is not attainable in other sciences. To arrive at a *correct* conclusion it is not enough to *reason* correctly, we must have *correct data.* Now, in physical science these data are only to be *in part.* For example, a result which *may* depend on the *pressure of the atmosphere alone,* or which may *also* involve its hygrometric state, has to be determined. We may first *suppose* that it depends *only* on the pressure, and reason correctly on that hypothesis, but the *result* is not correct unless the hygrometric state be in reality without influence; or, which is perhaps a case more likely to happen in reality, we may have assumed this result to depend on both these two quantities—viz.: the pressure and the quantity of moisture in the air; but *suppose* the latter quantity to be unaffected by the former. If it should turn out that they are mutually dependent, our conclusion would be incorrect, though our reasoning were as good as Euclid's. But suppose we had to settle the question mathematically—calling one quantity (x) and the other (y). We might, (if the differential and integral calculus were required in the solution,) first, go through the calculation on the hypothesis of their being *independent* variables; and, secondly, make one a function of the other. While, therefore, the *physical* question would necessarily remain undecided—so long as we remained ignorant of the real laws of nature on the case—the *mathematical* question could be completely solved, and the result ready to be applied to the physical question, as soon as ever future inquiry should determine which of the two sets of calculations was to be taken.

(*To be continued.*)

CAUSE OF LOCOMOTIVES GOING OFF THE RAILS.

Sir,—Have the following consequences of the usual construction of locomotives, ever been inquired into experimentally? The cranks on the axle of the driving wheels, are, as everybody knows, placed at right angles to one another, for the very purpose of having the greatest action on one at the moment of least action on the other. Now, it is very obvious that another end, by no means so desirable, is at the same time necessarily accomplished. For one wheel is thus constantly tending to go on with a greater velocity than the other, producing in fact a rotary motion in a horizontal direction, round the centre of gravity of the engine—to the right and left alternately. So that, in fact, the path of the axle-tree is zig-zag instead of straightforward: thus,

Fig. 1.



and the flanges of the wheel instead of moving parallel to the rail A B, jog against it, as represented in fig. 2.

Fig. 2.

The effect is similar to what would be produced in a boat, if the rowers on one side were to pull their strongest, whilst those on the other were pulling weakest. The boat would move off *from* that side where the strongest pull was being made, and would describe a zig-zag path in the water. It would be "*sculling*," instead of rowing.

Any one who has ever rode on the engine itself, must have been surprised at finding this vibratory motion so much greater than he would expect.

It is the same in nature and cause, I conceive; only less in degree than that which may ultimately carry the engine completely off the line. I believe too, that in most of the accidents which have happened, precisely the same kind of cutting and twisting of the rails by the flanges, has been noticed for some space, as what would be produced by such a motion as shown in fig. 2.

Have axles with similarly situated cranks ever been tried—if so, with what effect? If in stationary engines the acquired momentum is found sufficient to carry the crank beyond the "line of centres"—why not in locomotives? It is true, the engine would proceed by a series of impulses—just as a boat in the water; but after the engine was fairly started, I do not think the alteration of velocity would be perceptible—or at any rate, injurious. The tendency to rotary motion would at least be absent—and this is most obviously of the greatest danger.

Yours respectfully,

A. H.

SCIENTIFIC MORALITY AT CAMBRIDGE.

Sir,—As you have referred to my letter by the signature of "P. P.," I proceed to make a few remarks on your article in the last number.

1. That letter was, as you are aware, *not* intended for publication.

2. Both "Q. Q." and myself are charged with "*defending*" a whole lot of things, of which I, for one, never dreamt of undertaking any "defence"—viz.: the "whole system" of book-stealing.

3. The writer has forgotten that the very fact of the plates in Hymers' Astronomy being still marked "Maddy's Astronomy," is quite sufficient of itself to show that the work was not claimed as original.

4. The injustice to the public, however, and most especially to *poor* students, of hashing up an old dish with a new name, and thus misleading the purchaser,—is, most assuredly, a vile piece of mean deceit and downright dishonesty, which I regard with as much contempt as any one. I would merely ask, however, whether the amount of alteration and enlargement of Maddy's work is, or is not, sufficient to fix this charge on Dr. Hymers? I ask, in order to be informed—for I am altogether unacquainted with "Maddy's" orinal edition.

5. The observations on the bad effect of the Cambridge system of reading, *merely* in order to write out, express exactly my own views of the matter—and to which I can testify from my own observation. Whilst I am convinced that no knowledge is worth two pence which a man cannot *produce*—either on paper or orally, I am equally convinced that this producing of certain propositions on paper is *not* a proof of their being understood, inasmuch as a very great portion of the "book-work" is crammed down and battered in by the unceasing labour of three years—and many men who have taken high degrees are, in fact, really unacquainted with some of the most important *principles* of mathematical science.

The writer is mistaken, however, with regard to the problems. Has he tried his hand at the dynamical ones? If so, he cannot be ignorant that nothing but severe *thinking* will ever lead to the solution of any but an exceedingly small part. If these be solvable so easily by "the legerdemain of symbolism," I should very much like to *see them done*, and I happen to know, that some first-rate mathematicians in France, as well as here, have committed great blunders in their attempts at some of these problems. I should also be glad to see a collection of the solutions of these in pure mathematics, or even references to their solutions, in any journal. I dare say, however, if the writer's real opinion were fully understood, he would confess that there is quite enough in any Cambridge problem paper to try the best and most skilful.

6. "We know sufficiently well, that

we can write nothing worthy of being quoted or referred to at Cambridge," &c. Being entirely ignorant as to who the "we" refers to, I can only say, that the feeling with which this is written has in reality no rational foundation, and that the writer *is* a "little" prejudiced, whether he knows it or not. What are the facts? Men go to Cambridge, as the writer himself has reproached them—*not* to learn mathematics, but to obtain the necessary preliminaries to ordination, &c. Not one undergraduate in a hundred cases, cares one straw about science or its cultivation, and would just as soon read a book by a Hottentot as by a Cambridge professor—in fact, much sooner, *if it were shorter*. These, then, are out of the question when the neglect of non-academic mathematicians is concerned. How then have the tutors and book-writers acted? The principal English mathematicians who do not belong to the Universities are, Professors Barlow, Ivory, Davies, and Rutherford, of Woolwich, and a few of the contributors to the Diaries, including, Woolhouse, &c. No one can charge University writers with neglect of Barlow and Ivory, or of Hodgkinson. Every Cambridge author, whose subject has anything to do with their labours, mentions them with as much honour and respect as they themselves could wish for. Professor Davies's researches in geometry are particularly referred to by Hind in his Trigonometry, and his various papers would be much better known and appreciated if published separately. But when scattered in all sorts of periodicals—few of which are ever heard of at the University—how can tutors and others, who have so little acquaintance with uncommon periodicals, be expected to find them out? My own acquaintance with different periodicals happens to be more extensive than most people care to trouble themselves with—and yet I never heard of Mr. Davies's researches in terrestrial magnetism, before he himself referred to them in the *Mechanics' Magazine*, on the occasion of another person having treated some parts in a similar way. When his promised work on descriptive geometry is published, I have no doubt it will be appreciated at Cambridge, as well as elsewhere; and I may mention as an example of how totally mistaken a notion it is, to ascribe partiality and neglect to Cambridge men in general, that I have myself heard the opinion of one of the first mathematicians of the day (a Cambridge man), "that no one was better able in England to treat the subject than Professor Davies."

The contributors to the Diaries have done nothing but isolated problems—or nothing of any use in tuition; and so far as these labours go, I need only refer to the references in Walton's problems as a proof, that even these are not neglected.

Professor Young is a contributor to the Cambridge Transactions—and Mr. Woolhouse's merits in astronomy are well known and appreciated.

7. Finally, the charge that Cambridge men are invariably pushed into positions by dint of barefaced partiality, (though not made directly, it is yet plainly insinuated,) is most extraordinary. Can the writer be ignorant that more than two-thirds of those who take their degrees at Cambridge, if they be not men of property, are at this moment teachers in schools at salaries of from 50*l.* to 150*l.* a year (the majority perhaps at 90*l.* or 100*l.*), also curates at 90*l.* or 100*l.* a year (without anything else)? If isolated cases of partiality have occurred, by all means show them up, (I believe I can guess that to which allusion is made, viz., the recent election at Woolwich); but such a *general* charge is most notoriously and egregiously without foundation—if not, prove it.

P. P.

THE SOCIETY OF ARTS.

For the last five years this Society has been in a state of unceasing change—oft complaining of failing strength, and ever and anon boasting of perfect renovation — no sooner put through one restorative process which was to put all to rights, than subjected to another, the anxious adoption of which showed the true physician still to be wanting. Last year the hopes of the society were centred in a certain "Northern Light," but now it is from Windsor's towers the star of hope sheds its beams. The character of this new turn in its fortunes—the most remarkable, perhaps, of any that has yet taken place—may be gathered from the following House, or

Official Abstract of a Report made by the Council of the Society at its first Meeting for the Season, 1846-47:

"The Report stated that formerly the Society, as is well known, stood alone as the great active scientific, mechanical, and artistic society of London, the Royal Society being the only other in any analogous position — that now, however, that great field is happily full of co-operating societies, each labouring on some one subject formerly a mere dependant on its vast territory—that this removal from the parent society of so many branches has necessarily stripped it of many of its bright ornaments, but it appears to the council that far from being regarded as an evil, this multiplication of useful societies is a subject for congratulation, and should be regarded as one strong proof of its past usefulness. The council consider that the field on which the society might with best effect *concentrate its future labours*, as well as that which most properly belongs to it, is a department of the fine arts, hitherto much neglected in this country, and which has been strongly approved of by H.R.H. Prince Albert, president of this society, viz., that of promoting high art in connexion with the mechanical, for which our manufacturers are so justly celebrated."

When it was, that the Society of Arts "stood alone as *the great active scientific, mechanical, and artistical society* in London," it would rather puzzle the council, we suspect, to show. "Well-known" "as is" this wonderful fact, it would be a safe thing, we apprehend, to offer the Society's best medal to any man of truth and honour who would make affidavit that he ever knew it before. Equally new, we doubt not, it will be to most people, as it is to ourselves, that the house in the Adelphi has been "the parent" of "so many branches"—of so many "co-operating societies, each labouring on some one subject formerly a mere dependant on its *vast* territory." Which may they be? To which of all the numerous societies of which the metropolis boasts can the council possibly allude? The Royal Society, we all know, prides itself on being the common parent of the "Antiquaries," the "Astronomical," the "Geological," the "Zoological," and so many more, that we do not see what there is left to affiliate to the Society of Arts. Nay, for the matter of that, the "Royal" might just as well have added the Society of Arts to its genealogical tree, as any of the others. We are reminded, indeed, by the report before us that the Society of Arts do not admit the "Royal" to be in any better than "an *analagous* position" to their own—each the "great" "parent" "trunk" of "many branches." But this is all idle talk. The only ground which either society can have for claiming any of the others for its offspring is the mere ground of seniority; and the case being so, it follows of necessity that whatever pretensions the folks in the Adelphi may urge on that score, those of Somerset-house can—*whenever they may think it worth while* — swallow them up at a gulp. One striking analogy there certainly is between the two societies, but it is of a sort which we are not sure the Adelphi council will thank us for pointing out. The apology which the Society of Arts now make for the feebleness of declining years is an exact transcript of what the Royal Society, or its leading members, made for its own decrepitude not many years ago; a resemblance rendered not the less remarkable by the fact that the same gentleman (Dr. Roget) who was secretary to the "Royal" on that occasion, officiated as president of the Arts on the present! *Certes*, both the *old women* talk very much alike.

We come, however, to more material matter. The report of the council states that "the field on which the society might with *best* effect *concentrate its future labours*" is "that of promoting *high art* in connection with *the mechanical*, for which our manufacturers are so justly celebrated;" and that this concentration of the Society's labours has been "strongly approved of by H.R.H. Prince Albert, president of this society."

May we be excused for asking what all this means? We have heard a great deal of late—on this as well as other occasions—of "*high art*" as something in which the artizans of England are wofully deficient; but we have never been fortunate enough to meet with a clear and intelligible explanation of what is meant by it, and for want of that explanation

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have been uncharitable enough to surmise, that it might be nothing more than a variety of that hydra-headed monster commonly called "humbug." Let us test the reasonableness of the cry by an inquiry or two. One artizan invents an improvement in time-pieces, by which they are made to perform with ten times greater correctness than was ever known before—an improvement involving, perhaps, not only great mechanical skill, but a most enlightened application of philosophical principles; while another invents a clock-case (to contain the other's workmanship) distinguished for elegance of design and richness of ornament. Which of these instances, may we ask, exemplifies the "*high*" art and which the contrary? Or (to cite a case of actual occurrence, which we have somewhere read of) one cutler produces a pair of scissars, fashioned so as to represent the Goddess Atropos in the exercise of her fabled office of snipping the thread of life, but the blades of which are of most indifferent metal withal; while another produces a pair perfectly plain, but of exquisite polish, of keen and enduring edge, and of metal tempered with such surpassing skill that, though oftener than twice is passed through the fire, yet on breaking one of the blades a small slip of paper, with the name of the maker is found in the centre of it perfectly uninjured. To which of these artizans ought the palm in "high art" to be awarded? We shall be told perhaps in reply, that there is "high art" in all of these instances—only of a different order in each. That is true, but certainly it is not in any such general and enlarged sense that the term "high art" is made use of by those who are at the head of the present movement in the Society of Arts. The prizes which have been since offered for competition by the Society show clearly that the "encouragement" of the ornamental, as distinguished from the simply useful in the arts, is the object on which they propose "to concentrate the future labours of the Society."—They are all for outward show—form before substance—French tinsel before the good old English "sterling bullion."—The clock-case would with them carry the day, while the genius which inspired the mechanism within would go unheeded; nor though Tubal Cain himself were to pay a visit from the shades to the Adelphi, would he have any chance against the classical fabricator of bad cutlery.

But why this divorcement of the ornamental from the useful? Why this concentration of the Society's future labours on the one, to the exclusion of the other? Where the necessity? Where the apology? We are not among those who think that English artizans are so much behind their neighbours in matters of taste as it is the canting fashion of the day to affirm—if, indeed, behind at all. We have a firm persuasion that the English artizan can not only do anything that any other artizan can do, but do it much better; and might refer for proof of this to a thousand incontestible instances. But the English artizan is an eminently practical man; he prefers working for those who can pay him best: his customers are the million, and the million not of his own country alone, but of the whole world. He must, of course, consult the tastes of his customers; and, as long as the tastes of the million everywhere, are of a vulgar and unrefined description, (which will probably be till the advent of the millennium at least,) he may be expected to exhibit in his handicraft productions a greater regard to the useful (which the rude and civilized are alike able to appreciate), than to the ideal and beautiful. But, without further enlarging at present on this view of the matter, and admitting, for the sake of argument, that our artizans have yet somewhat to learn in the way of "high art," we are at a loss to discover whence the Society of Arts has derived its high mission, to devote itself exclusively to their improvement in this respect. We do not find it in the original constitution of the society, in which equal regard is shown to the POLITE and to the USEFUL arts; neither can we discern any trace of it in the general feeling and understanding of artistical and mechanical circles. The only reason, in short, which we can discover for the change, is one which carries us back to the feeble, fitful, and flickering condition in which the Society has been for some years past, and which savours much more of desperation than of free choice. *Having ceased to be of any use to the "useful," nothing was left for them but to turn the leaf—be it to another brilliant future, or but to an utter blank.*

Well, who knows but they may yet do

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something for "high art" in mechanics; enough, perchance, to save them from the extinction which has been so long hovering over them? We cannot say that we hope much ourselves from their efforts in this line; but we would not willingly throw any obstacle in the way of their success. We do not apprehend that they can do any harm, do what they may, and we admit the perfect possibility of their doing some good.

The Society seem to hope much from an "exhibition" which they have got up of specimens of English arts and manufactures. We have more than once felt called upon to state our reasons for regarding all such "exhibitions" as wholly out of place in a country so pre-eminent in manufactures as ours;—that is to say, in the sense of exhibiting the degree of skill to which the country, or any district of it, has attained in arts and manufactures. The best hands will not contribute,—being placed, by well-established reputation and constant custom, far above all such adventitious aids; but many of the worst hands do, and more who are neither good nor bad. The Corn-Law-League exhibition was by far the best thing of the kind ever seen, and better than will, perhaps, ever be seen again in England; and yet who has ever been heard to say that it presented anything like a true picture of the state of English mechanical skill in the year 1845? The Adelphi exhibition forms by no means any exception to the general character of these exhibitions. It is, in fact, one of the most indifferent we have ever seen. To regard it—as some of our contemporaries are doing—as a *national* affair,—as furnishing adequate data by which to judge of the *national* progress in the arts—is a perfect farce. A person need but pass from the Adelphi into the adjoining street, to see all the specimens collected in the Society's house eclipsed by the first dozen or two of shops he comes to. Let him extend his walk eastward towards St. Paul's, or westward to Regent-street, and at every step he will see additional reason to be satisfied of the vanity of endeavouring to concentrate, in any one spot, a just representation of the ingenuity and skill of a people whose every shop is an "exhibition" of first-rate art—a storehouse of all that is most admirable in one branch or other of the mechanical arts.

ON MR. HEATHER'S ALTERATION OF DUCHAYLA'S PROOF OF THE "PARALLELOGRAM OF FORCES."

Sir,—In Art. 32, p. 13, of "Heather's Mechanics," Duchayla's proof of the parallelogram of forces is "established by successive inductions for all possible values of the forces;" and in order to effect this, Mr. Heather thus proceeds: "Now, if q and r be each equal to p, then our hypothesis has place in fact, (Art. 29), and our proposition is therefore true for the forces p and $2p$, as well as for p and p; it is therefore also true for forces p and $3p$, and therefore, again, for forces p and $4p$; and so on, by successive inductions for p and mp, m being any positive integer whatever." Similarly he shows that "being true for the forces mp and p" it is also true "for mp and np, n also being any positive integer." He then extends the proof to the case of *incommensurable* forces in the following manner, "*No restriction whatever has, in this investigation, been placed upon the value of* p*; it is therefore capable of being diminished without limit, while* m *and* n *may be increased without limit, and thus* mp *and* np *may represent any two forces whatever; and our proposition is shown, therefore, to be universally true.*" In reference to this part of the demonstration Mr. Heather says, "at present, I need only further notice the alteration that I have introduced into Duchayla's proof of the principle of the parallelogram of forces. As it has *hitherto* been given, the part relating to incommensurable forces, besides being indirect, assumes, as axiomatic, that by increasing one of the components, the angle between that component and the resultant is diminished." Now, in "Earnshaw's Statics," second edition, 1842, p. 10, we have the following: "*If the proposed forces* P, Q, *be incommensurable by taking* p *extremely small, and the integers* m, n, *correspondingly large, we can make* mp *differ from* P, *and* np *from* Q, *by less than any quantities which can be assigned; and we may then use* mp *and* np, *instead of* P *and* Q, *without any sensible error; and therefore the proposition is true of* P *and* Q."

If, then, there is no *real* difference between the two extracts given in italics, Mr. Heather is *not the first* who has

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"succeeded in making Duchayla's proof direct, without either using the above, or making any new assumption."

I am, Sir, yours, &c.,

THOMAS WILKINSON.

Burnley, Lancashire,
April 10, 1847.

MAGNIFICENT AURORAL ARCH.

Sir,—Friday, the 19th of March (1847) is rather a remarkable day, as being the period of equality between day and night; but the evening of that day was rendered still more remarkable by a grand display of aurora borealis, accompanied by the most splendid auroral arch the eyes of man ever beheld. The southern sky was brilliant with stars of the first and second magnitude, which rendered the course of the arch easily traceable. The new moon shone brighter than ever it did before in the third day of its age, and then there was the beautiful Venus in the horizon, and the planet Jupiter higher up in an azimuth nearly west; indeed, it was altogether a most magnificent scene for the county of Norfolk. But the "burden of my song" must be about the arch.

At a quarter to 9 o'clock, the arch had attained its greatest concentration of effect, its density being uniform throughout its whole length; its brilliancy and colour approximated to those of a pale full moon; its edges were almost as neatly defined as those of the rainbow. The east end of this arch rested exactly upon the star *Eta* in the constellation Bootes, a short distance from Arcturus; and after passing through Coma Berenice, into Leo, its lower edge passed over the star Regulus; in its onward course, its lower edge was observed to be in contact with the star *Beta* in Canis Minor, a few degrees above Procyon. It then passed onward into the brilliant constellation Orion, where it exactly filled the space between the bright star Bellatrix, and that at the west end of Orion's belt, thus getting into an exact gauge for its breadth, between 6 and 7 degrees. It now passed the equator into the southern constellations, and after tracing its own beautiful curvature into Eridanus, it finally terminated in the horizon. Phenomena nearly similar to these, occurred in the evening of the 3rd of December 1845, and in both instances the direction of the arch lay at right angles with magnetic meridian.

If it be possible to calculate the height at which these arches are formed in the atmosphere, by means of observations made in different latitudes, a correct reference of them to the starry heavens, may be of some interest and use to men of science, and become proper subjects of insertion in the scientific journals. I never read any of the late Dr. Dalton's writings, but have been informed that the eminent philosopher actually made such calculations; would it not be of interest to have them confirmed? I may state my own latitude to be 52 degrees 50 minutes.

Yours truly,

J. LOOSE.

Woolverton, Norfolk, April 1, 1847.

MR. TREVITHICK'S ORIGINAL MODEL OF HIS HIGH-PRESSURE LOCOMOTIVE STEAM ENGINE—1806.

Sir,—In the Memoir of R. Trevithick, which you have reprinted, mention is made (at p. 306) of a working model of his engine, which was exposed for sale in the shop of Mr. Rowland, in a street near Fitzroy-square. (That name is printed incorrectly, the real name was Rowley, and the street Cleveland-street.) Amongst old manuscripts which escaped the wreck of my collection by fire about two years ago, is a sketch of that model which I took in 1806. In those days a really working model of any steam engine was considered a great curiosity, which did credit to the maker, and that one was the more interesting as representing the first locomotive engine which Mr. Trevithick made, and tried on the iron tram-road at Merthyr Tidvil, in South Wales.

The different volumes of your Magazine contain some articles on old projects which are of historical interest, as the originals of improvements afterwards brought into use; for instance, Symington's locomotive (vol. xviii. p. 33), Murdoch's (vol. xx. p. 181), Bentham's steam dredging (vol. xliii. p. 113), Oxley's steam vessel (vol. xxxv. p. 66), and others.

That I consider to be a useful part of your miscellany, which it would be desirable to extend, and no doubt with satisfaction to your readers. You have before you a very old example in the *Gentlemans' Magazine*, which during a course of years contained a great number of fragments of antiquarian research

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in architecture, &c., which are constantly referred to; but it is to be regretted how few points in the history of useful inventions have been accurately recorded, and it is open for you to supply that deficiency as far as it can be done.

It is with pleasure I see that my esteemed friend, Mr. J. T. Hawkins has contributed a scrap (at p. 308) relative to Trevithick's locomotive The reminiscences of his long and observing career may furnish you with many more.

Note, respecting Mr. Hawkins' statement of 12 miles per hour, it should be understood that his observation was taken when the engine was travelling alone, without drawing any load after it, not even a tender. If you are disposed to devote a page of engraving to Mr. Trevithick's model, a drawing shall be sent to you for your next number.

I am, Sir, your most obedient,

JOHN FAREY.

[We shall have pleasure in giving an engraving of the model referred to by Mr. Farey.]

THE LAW OF STORMS.

[From the New York *Journal of Commerce.*]

The severity of the gales which have occurred during the present autumn (1806,) has attracted the attention of all who are interested in the commerce of the ocean. The heat which prevailed in the Atlantic States during the first week in September, was dissipated by a storm which swept along our coast, or rather by *two* gales, one from the northern islands of the West Indies, and the other from the Gulf of Mexico, which, about the latitude of 30°, nearly coincided in their progress, and caused serious losses in our navigation.

About the 12th of September, another gale appeared at Barbadoes and the windward islands, moving with a north westerly progression towards longitude 70°, near which meridian it recurved gradually to a north westerly progression, its right limb touching Bermuda on the 17th and 18th, sweeping over the Island and Banks of Newfoundland on the 19th and 20th, and causing great destruction among the shipping which fell in its path. This gale was of great extent and violence, as appears from the reports of the *Great Western* steamer and our packet ships, having been far more destructive in the higher than in the lower latitudes. We have abundant means of tracing its progress as far eastward as longitude 29°, and there is little doubt of its further progress to the eastern shores of the Atlantic Ocean.

Late in September, another gale, from the Gulf of Mexico, appeared on our coast. About the 5th of October still another severe storm passed near the coast, proceeding towards the Banks of Newfoundland.

The storm which visited New York on the 13th of October will long be remembered, on account of its destructive violence at Key West on the 11th, and also at Havanna. The earliest report which I find of this storm, is that of the brig *Cora*, in the Caribean Sea, off Maracaibo, on the 5th of October;—and the identity of the *Cora's* storm with that of Savannah and Charleston on the 12th, and New York on the 13th, has appeared highly probable, even before the disastrous accounts were received from Key West and Havanna, occasioning apprehensions which have since been realized. The appropriate and timely communication in the *Mobile Herald*, from Captain Engle, of the U. S. ship *Princeton*, now confirms and establishes the supposed identity and route of this storm;—the *Princeton* being at that period in the Caribean Sea, and running toward Pensacola. There is still room to apprehend disastrous accounts from Jamaica, particularly from its south side and west end, although the central and most violent portion of the hurricane appears likely to have passed to the southward and westward of Jamaica, in pursuing its course towards the western portion of Cuba.

It is important for navigators to notice that these several gales *were great whirlwind storms*, moving forward on great curves of progression towards higher latitudes, while revolving rapidly round their own centres, from right to left, in accordance with the known law of storms in the northern hemisphere. In this common and essential feature, they have resembled the great Cuba hurricane of October, 1844, which, in its destructive progress, passed near to our coast. An examination of the accounts of this last-named storm, as published in the American Journal of Science for May, September, and November, of the present year, will show demonstratively its rotary character; which is also common to all our great storms, and which must be clearly understood by navigators in order to secure the adoption of the best means of safety in these gales. The accounts of this storm, in the *Journal of Science*, are accompanied by charts, on which are shown the daily progress and advancing positions of the storm for three successive days, at intervals of three hours on each day, with the direction of wind prevailing at these several times in different parts of

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the storm, as derived from the various observations which are there given. * * * The storm was about one thousand miles in diameter, and moving towards the north-east at the extraordinary rate of more than forty miles an hour.

By means of a due examination of those charts and accounts to which I have referred, the changes of wind which must take place under different portions of the storm as it advances in its track may be clearly known, as well as the advantage or disadvantage which may be likely to result from any change in the course or position of a vessel while under the storm.

The commercial world is greatly indebted to Col. Reid, R.E., now appointed Governor of Barbadoes, and also to Mr. Piddington, of Calcutta, and Surgeon Thom of the British army, formerly at Mauritius, for their successful labours in establishing the universality of the natural law which governs the tempests, both in the northern and southern hemispheres, as well as in pointing out to mariners the most available means for escaping those dangers or for encountering the same successfully. Mr. Lee, editor of the *Bermuda Gazette*, has also aided much in extending this knowledge among nautical men.

It may well be doubted if our navigators can longer neglect or disregard the known law of storms without seriously jeopardizing both their professional credit and their highest usefulness. In view of the advantage which may result to navigation, it is desirable that ship-masters should report their latitude and longitude in any gale which they may encounter, and also the direction and shiftings of its winds. Much practical benefit may be derived from such reports.

W. C. R.

New York, Nov. 10, 1846.

MANURE.

Sir,—In your February Part (p. 203.) is a letter from a "Farmer," giving a receipt for rendering "fecal matters" inodorous. Hoping that some of your chemical readers would have published their opinions in your pages upon his recommendations, I have not troubled you with the following remarks, until now; but seeing nothing appear upon the subject in your March Part, allow me to state that I am afraid what he suggests will render the *improved* article nearly, if not quite, useless; for, if I am not much mistaken, "sulphate of iron" is a decided anti-manure; in fact, will quite destroy vegetation, if applied in any considerable quantity. His other articles of burnt earth, lime, and coal, are all very well upon a heavy clay, but upon light land very injurious; and therefore, I hope your agricultural readers, "Farmer" included, will consider well before they have recourse to this French recommendation, and take my advice to use the article treated of, as it is, for though of an offensive smell, it is of use.

I am, Sir, no Chemist,

But your old subscriber,

T. W.

Esher, Surrey.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS, FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 335.

CONTINUED FROM P. 335.

[From the Reports of the Deputy-Keeper of the Public Records, (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

John Peltrau, of Upper Moorfields, handkerchief weaver, and *William Naylor*, Stepney, dyer: of an invention of tying the spots of silk handkerchiefs in the imitation of India handkerchiefs (preparatory to dyeing the same). Cl. R., 21 Geo. 3, p. 6, No. 16. July 27, 21 Geo. 3; Nov. 2, 22 Geo. 3, 1781.

Walter Taylor, of Southampton, block maker: of a great improvement in the construction of shivers or pulleys for ships' blocks, which are better adapted for the rigging of ships, and other purchases, than any now in use: part of which invention will be of use for boxes of wheel carriages of all kinds. Cl. R., 21 Geo. 3, p. 9, No. 5, June 5, 21 Geo. 3; August 25; 21 Geo. 3, 1781.

Thomas Beckwith, of York, painter: of an invention of making crayons for drawing and other purposes of various colours, superior to any heretofore made. Cl. R., 21 Geo. 3, p. 16, No. 4. July 28, 21 Geo. 3; Sept. 24, 21 Geo. 3, 1781.

James Reaves, of Chesterfield, table fork maker: of a new invented art of making table fork blades, both scale and round; tongs with two, three, or more prongs. Also spring knife scales, commonly called Tutteam or Pocket Knife Scales, of various sorts, cast from cast metal, called Pig Iron, either entire of the metal, or intermixed with steel or other metal or metals, which, by a new preparation of tempering the several articles, renders them sufficiently strong and elastic for every purpose and use to which the same may be applied. Cl. R., 21 Geo. 3, p. 21, No. 2. February 21, 1781, 21 Geo. 3; May 31, 21 Geo. 3, 1781.

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George Dundas, of Banbury, whip maker: of a new method of spinning of Jersey, by a new and useful engine, machine or instrument not before known. Cl. R., 21 Geo. 3, p. 21, No. 1. March 28, 21 Geo. 3; June 19, 1781.

James Watt, of Birmingham, engineer: for certain new methods of applying the vibrating or reciprocating motion of steam or fire-engines to produce a continued rotative or circular motion round an axis or centre, and thereby to give motion to the wheels of mills or other machines. Cl. R., 22 Geo. 3, p. 1, No. 5. Oct. 25, 22 Geo. 3; Feb. 13, 1782.

William Playfair, of Handsworth (Stafford): of a method of making tongs, spoons, knives, forks, and medals, out of solid silver, or other metal, which will tend greatly to reduce the price of those articles. [By rolling.] Cl. R., 22 Geo. 3, p. 3, No. 20. Dec. 29, 22 Geo. 3; April 15, 1782.

James Watt, of Birmingham, engineer: of certain new improvements upon steam or fire engines for raising water and other mechanical purposes, and certain new pieces of mechanism applicable to the same. Cl. R., 22 Geo. 3, p. 4, No. 13. March 12, 22 Geo. 3; July 3, 1782.

Charles Smith, of Manchester: of a machine for dressing or bolting of flour and meal. Cl. R., 22 Geo. 3, p. 9, No. 8. December 24, 22 Geo. 3; April 20, 22 Geo. 3, 1782.

Joseph Greenwood, of Great Coggeshall, gent.: of new invented balls for the use of cleaning leather breeches, gloves, belts, &c., which will be found very useful, particularly to the army. Cl. R., 22 Geo. 3, p. 19, No. 3. July 30, 22 Geo. 3; Nov. 14, 23 Geo. 3, 1782.

Joseph Peover, of North-row, (Middlesex,) saddler: of a method entirely new of making a man's saddle upon such a construction so as therewith completely to fit horses, mares, geldings, and mules of all sizes equally alike; and also a woman's saddle upon such a construction so as therewith completely to fit horses, &c. Cl. R., 22 Geo. 3, p. 20, No. 8. Jan. 9, 1782; April 1, 22 Geo. 3, 1782.

George Beauchamp, of Saint Paul's Church-yard, London, cabinet maker: of a new invented curious machine for the greater safety and more expeditious manner of escaping from fire. Cl. R., 22 Geo. 3, p. 22, No. 22. April 15, last; August 6, 22 Geo. 3, 1782.

Philip Besnard, of Brewer-street, Westminster, chemist: of a new machine, called an Alembical Lamp, or Lantern. Cl. R., 22 Geo. 3, p. 24, No. 12. July 20, 22 Geo. 3; Oct. 10, 1782.

Thomas Gale, late of New Bridge-street, London, but now of Greek-street, Westminster, chemist: of a new invented medicine, or drops, called, or intended to be called, Spa Elixir, or Gale's Spa Elixir. Cl. R., 22 Geo. 3, p. 24, No. 11. July 31, 22 Geo. 3; Oct. 31, 1782.

Edmund Saunders, of Plymouth, merchant: of a new invented mixture, or composition, to be called Naval Black Varnish, to be used in paying the yards, top masts, bowsprits, bends, blocks, anchors, &c., of ships, instead of tar and lamp black, which has been generally hitherto used for those purposes. Cl. R., 22 Geo. 3, p. 24, No. 10. May 2 last past; June 11, 22 Geo. 3, 1782.

William Boothman, of Mosney, dyer: of a new and peculiar art or method of making iron liquor, or the preparation commonly called or known by that name. Cl. R., 23 Geo. 3, p. 2, No. 3. Nov. 16, 23 Geo. 3; Feb. 22, 1783.

James Gerard, of Liverpool, surgeon: of a new and improved process or method of obtaining and producing mineral and vegetable alkalies, contained in rock salt, brine salt, salt made from sea water, salt refined from rock salt, Glauber's salt, and vitriolated tartar, by separating them from the marine and vitriolic acids. Cl. R., 23 Geo. 3, p. 7, No. 9. May 7, 23 Geo. 3; Sept. 1, 1783.

John Joad, of Ramsgate, in the Isle of Thanet, upholder and glass grinder: of a mill or machine for the purpose of grinding and polishing all sorts of glass, and at the same time sifting and serving the sand used for that purpose. Cl. R., 23 Geo. 3, p. 10, No. 14. Sept. 19, 1782; Jan. 10, 23 Geo. 3, 1783.

Robert Heyward, of Kelvedon Hall, (Essex,) farmer: of a new invented stirrup for saddles, constructed on a new principle entirely to prevent accidents of entangling the foot. Cl. R., 23 Geo. 3, p. 12, No. 9. June 2, 23 Geo. 3; Sept. 25, 23 Geo. 3, 1783.

James Playfair, of Howland-street, (Middlesex,) surveyor: of a shaving box upon an entire new construction, the manner of using which, according to the specifier's invention, will very much facilitate the operation of shaving. Cl. R., 23 Geo. 3, p. 13, No. 28. Nov. 28, 23 Geo. 3; Jan. 3, 1783.

Charles Lander, of Islington, gent.: of a new invented universal wheel or engine, calculated for the better working of all kinds of machinery which require power and velocity, than any other heretofore discovered. Cl. R., 23 Geo. 3, p. 13, No. 19. Oct. 25, 23 Geo. 3; Feb. 8, 23 Geo. 3, 1783.

Thomas Harpur, of Leixlip, Kildare, calico printer: of a machine for watering yarn or cloth on whitstering grounds, crofts, or calico printing grounds. Cl. R., 23 Geo. 3,

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p. 13, No. 11. Nov. 16, 23 Geo. 3; January 28, 1783.

John Collison, of Battersea, chemist: of a new method of producing or making mineral or vegetable alkali. Cl. R., 23 Geo. 3, p. 13, No. 10. Nov. 4, 23 Geo. 3; March 1, 1783.

Francis Proudfoot, of Broad-court, Long-acre, shoemaker: of new constructed buckles, with new invented fastenings. Cl. R., 23 Geo. 3, p. 13. No. 3. December 2, 23 Geo. 3; March 24, 23 Geo. 3, 1783.

John Tylor, of Wood-street, Cheapside, brazier: of an invention, whereby tea and coffee urns, and other copper vessels, are securely tinned or lined, and are not subject to corrode or become verdigrised, and whereby such tea and coffee urns, and other vessels, are rendered more elegant, complete, and useful. Cl. R., 23 Geo. 3, p. 14, No. 15. Jan. 20, 23 Geo. 3; May 16, 23 Geo. 3, 1783.

Thomas Wright, of the Poultry, watchmaker: of a new invented watch, or time-keeper. Cl. R., 23 Geo. 3, p. 14, No. 10. Feb. 1, 23 Geo. 3; May 29, 23 Geo. 3, 1783.

Moses Samuel, of King-street, Tower-hill: of a new constructed alarm gun, or safeguard, for the better securing of houses, and other buildings and places, from being broken open and robbed. Cl. R., 23 Geo. 3, p. 17, No. 16. June 6, 23 Geo. 3, Oct. 1, 23 Geo. 3, 1783.

John Broadwood, of Great Pulteney-street, Golden-square, harpsicord and piano-forte maker: of a new constructed piano-forte, which is far superior to any instrument of the kind heretofore discovered. Cl. R., 23 Geo. 3, p. 17, No. 7. July 17, last; Nov. 15, 24 Geo. 3, 1783.

Jacob Bernard Haas, of Great Marlborough-street, Westminster, mathematical and philosophical instrument maker: of a new invented machine, or air-pump. Cl. R., 23 Geo. 3, p. 20, No. 4. Aug. 22, 23 Geo. 3; Dec. 11, 1783.

Jean de Conolle, late of Paris, but now of Piccadilly, London, mineralist: of a factitious coal to supply the use of charcoal, more efficient in its qualities and perfectly innocent in its effects. Cl. R., 23 Geo. 3, p. 20, No. 2. Sept. 12, 23 Geo. 3; Nov. 14, 1783.

John Hayne, of Nottingham, hosier: of a certain engine or machine to be fixed to a common stocking frame, for the laying and disposing of a number of threads in such a manner as to make several pieces or breadths of work on the same stocking frame, and at the same time by a method entirely new. Cl. R., 23 Geo. 3, p. 21, No. 9. Dec. 19, 23 Geo. 3; April 7, 23 Geo. 3, 1783.

Thomas Oldham and *George Prestwidge*, of Holfield-gate, Shirland, (Derby,) gentlemen: of an engine or machine constructed upon peculiar principles entirely new, and which, upon repeated trials, the specifiers have discovered will be very useful in spinning of hards or refuse flax, as also in spinning of flax, hemp, and wool. Cl. R., 23 Geo. 3, p. 23, No. 4. May 7, 23 Geo. 3; Sept. 5, 23 Geo. 3, 1783.

John Hatchett, of St. Martin-in-the-Fields, Westminster, coachmaker: of a new invented art or mystery for coaches, and al other carriages and bodies of them, that is to say, the bodies made for all panels to put in and to take out when required, lining the same, to have two sets of panels to each body, the one set richly ornamented and slightly varnished, lining answerable, to take out and to put in, the other set finished plain for travelling; the panels for those and all other bodies, new or old, prepared in a particular manner for strength, neatness, and conveniency, and to stand any climate or any sort of weather, as follows: to be mahogany panels, or any other sort of wood proper for the use, prepared with oils and varnish colours, and to be laid all over on one or both sides with a strong canvass, strained on and well worked, when they are dried to be prepared and filled up with oil varnish and colours and japan [this preparation, which is intended to prevent the wood cracking or splitting, is applicable also to wood whereof are made any articles intended to be painted, ornamented, or highly varnished], the wheels for the said coaches and all other carriages, the felloes reduced in length, or kept to the usual length as required, and instead of the joints of the felloes coming between the spokes, which is done in common to all wheels now in use, the joint between the two felloes come to the centre of each spoke, so as to have a firm bearing, and each joint to be cross by edge plates riveted. Cl. R., 24 Geo. 3, p. 2, No. 23. Oct. 25, 1783; 23 Geo. 3, Feb. 17, 1784.

MR. MUNTZ'S PATENT SHEATHING METAL.

[Patent dated October 15, 1846; specification enrolled April 15, 1847.]

The patentee states that the object of his present invention is an improvement in the manufacture of his sheathing metal, for which letters patent were granted to him October 22, 1832, and which consisted in making a sheathing metal for the bottom of ships or vessels, of an alloy of sixty parts of copper and about forty parts of zink, whereby the cost of the material has been very greatly diminished. In this alloy the copper was, to a great extent, preserved; although sufficient oxydati n was obtained to keep the bottom of the ships or vessels,

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so sheathed, clean; and separate action on the zink prevented.

Now, by the present invention, Mr. Muntz proposes to diminish the proportion of copper hitherto employed in the alloy, and thereby the cost of the article. For this purpose, he makes the alloy according to the following new proportions:—Fifty-six parts of copper; forty and three-quarters parts of zink; and three and one-quarter parts of lead.

The alloy is then cast into ingots, rolled into sheets, by preference, at red heat, and annealed; and, if desirable, may be polished in the ordinary manner, by using nitric and sulphuric acid, properly diluted. The patentee remarks, that the lead acts a very important part in this alloy, as, without it, the fifty-six parts of copper, and forty and three-quarters parts of zink, would not oxydize sufficiently to keep the bottoms of the ships or vessels clean—nor would separate action on the zink be prevented; and further, that, instead of lead, any other suitable metal or metals may be used.

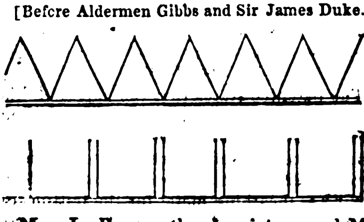
The patentee further states, that he is well aware that it has already been proposed to mix lead or other metals with copper and zink, and that he prefers lead, although he does not confine himself thereto, nor to the exact proportions before mentioned; for the proportion of copper may be increased, and, of course, the cost; or it may be diminished, but not to be of any practical utility, below fifty per cent. And he declares what he claims is, the manufacture of a sheathing metal for the bottoms of ships or vessels, which shall contain a less proportion of copper than sixty parts of copper and forty of zink, by so using any other metal or metals that oxydation shall be obtained, and the bottoms kept clean, and separate action on the zink be prevented.

CASE OF ALLEGED INFRINGEMENT OF REGISTERED DESIGN.

Guildhall London, April 12, 1847.

WEBB *v.* HUGHES.

[Before Aldermen Gibbs and Sir James Duke.]



Mr. J. Payne, the barrister, and Mr. Tippetts, a solicitor, appeared to support the complaint; and Mr. Clarkson and Mr. Wordsworth attended as counsel, and Messrs. Devonshire and Wilson as solicitors, for the defendant.

The information charged that Mr. Webb, of Wood-street and Manchester, had registered an original design for a protective rouche tray, and that Mr. Hesketh Hughes, of Cripplegate-buildings, had sold a fraudulent imitation of such design.

"Rouche," it was explained, is a piece of thin lace, about two inches in width, and a yard in length. The lace is first crimped (or goffered, as it is termed); a thread is then run down the centre, and next the lace is folded in half. It is then ready for use, either as ladies' "whiskers," or as a double frill border round a cap, &c.

Mr. Payne said, he understood the question was to be met upon its merits, but he was prepared to go into the preliminary proof by putting in the certificate of registration, proving that notice was given to the defendant not to infringe on the register, and that he had, nevertheless, sold the fraudulent imitations of the design subsequently.

Mr. Clarkson said, he would give him no trouble on these points.

Mr. Payne proceeded to explain the state of things before the invention registered by his client. The rouche lace was kept in round boxes containing three tiers, and the mischief was that only one-third of the lace could be shown at a time, and no part of it could be removed without disturbing the rest. The complainant, who is a rouche maker, invented a box for his goods which enabled a draper to exhibit the goods better, and to remove any portion without disturbing the rest. Instead of a round deep, he had a long shallow one, and instead of laying strips of paper between each row of lace, he folded a sheet of paper so as to form a series of ridges. The lace was then put into the troughs between the ridges, two of which troughs held a complete length of lace. It contained 12 yards, like the round boxes, but presented the whole to view at once. About six weeks after the registration the defendant registered the infringement. By ripping open the top of each ridge he was enabled to put into the tray nearly double the quantity. This might be an improvement, but it was neither law nor common sense that, if a man added some little improvement to another man's original and novel design, the improver should take the benefit of the whole. In such a case the improver must either make an arrangement with the inventor, or wait till the inventor's term of registry or patent expired. He referred to Webster's work on the Patent Law, and urged that the cutting open the tops of the ribs or ridges, all the rest being precisely the same, was but a colourable change, and, in fact, a fraudulent imitation.

Mr. Capelain, a registration agent, deposed

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that he prepared Mr. Webb's specification. The ridges were all complainant claimed as novel; and the defendant had copied these; slitting the ridges open at the top.

Cross-examined by Mr. Clarkson.—The defendant's tray exhibited the plain edge as well as the two goffered edges, which the complainant's did not. The complainant's box was ten inches wide, and the defendant's about six inches. The length of each was the same. Both contained the same quantity.

Mr. Clarkson said, there was no infringement in this case. The specification of the complainant's invention was insufficient; for it did not specify what parts were new and what were known before, as particularly required by the Act. It was not new to put lace into an oblong paper box, nor to put slips of paper between the rows of lace; but it was new to fasten the strips of paper to the box, of which the specification took no notice; and it was new to have a sheet of paper folded so as to present a series of ribs instead of having separate loose ribs. The specification, however, contained no statement of what was new and what was old, as the Act required. Again, the reference to what was old, and what was therefore defective. The Act had reference only to matters of form. It was nothing that the same principle or idea was taken up, if the form and means were different. Principles were protected by the patent law, and mere shape by the registration law. If he showed that the shape was different, and essentially more useful, he should relieve his client. The complainant's invention was a series of triangular ridges. The defendant's was a series of detached pieces of paper, folded to form three sides of a square, the bottom side being pasted to the bottom of the box; and the effect was to obtain a saving of nearly half the space, and show the plain as well as the crimped edges of the material. Space was a great object in sending goods into the country or abroad. The complainant's divisions were like a V inverted, (see fig. 1,) and the defendant's of a square form, (see fig. 2.) If, then, a square were a different form from a triangle, there was no imitation here of the shape registered by Mr. Webb. He called several witnesses.

Mr. Reuben Hansoll, from Messrs. Grocock's, said, they were the largest dealers in Rouche lace in the world. They sold about 1,800 boxes per week. Mr. Webb invented the ridges, but Mr. Hughes's plan was much better. It was important to see how both edges (the folded and the goffered edges) were made, which could not be shown by the ridges. The space saved was a great object, and they sold twelve of Hughes's to one of Webb's on that account.

Mr. Brooman, of the house of Messrs. Robertson and Co., patent agents, stated, that it was under their advice the defendant had registered his design; that they had previously compared it with that of the plaintiff, and had considered the two designs essentially different in point of shape and configuration.

The magistrates retired, and, after being absent some time,

Sir J. Duke said, they felt great difficulty in deciding on the case, and they therefore left the parties to pursue any other remedy they had.

From questions put by the magistrates, it was evident that they had formed different opinions; Mr. Alderman Gibbs, thinking the defendant's plan a piracy of the complainant's; and Sir J. Duke, that the shape was essentially different, and the defendant's tray far more useful to the trade.

The complaint, therefore, was in effect dismissed.

LIST OF ENGLISH PATENTS GRANTED FROM APRIL 8, TO APRIL 15, 1847.

Charles Minesa Collett, of 62, Chancery-lane, Middlesex, for certain apparatus and arrangements for affording additional security in locks. (Being a communication.) April 15; six months.

Alfred Vincent Newton, of 66, Chancery-lane, Middlesex, mechanical draughtsman, for improved apparatus to be applied to steam boilers. (Being a communication.) April 15; six months.

Samuel Childs, of Earls-court Road, Middlesex, wax-chandler, for certain improvements in the manufacture of candles, and in preparing and combining certain animal, vegetable, and mineral substances applicable to the manufacture of candles and other uses. April 15; six months.

John Mollett, of Austin Friars-passage, London, merchant, for improvement in fire-arms and in cartridges. (Being a communication.) April 15; six months.

Stephen White, of No. 30, Winchester-row, New Road, in the parish of Marylebone, Middlesex, for a new means of producing gas, both as to apparatus and materials from which the gas is produced. April 15; six months.

Peter Claussen, of Leicester-square, Middlesex, gentleman, for certain improvements in weaving machinery, and in the preparation of the materials employed in weaving. (Being a communication.) April 15; six months.

James Robson, of Dover, engineer, for a new and improved instrument to be used in crushing or pressing oil from vegetable and other substances, and in making oil-cake, and which instrument is applicable to the moulding, pressing, and manufacturing the same and other articles from plastic materials. April 15; six months.

Advertisements.

H. ELLIS,

MACHINIST and MODELLIST, of 9, Three Kings Court, Lombard Street, begs to acquaint those engaged in Mechanical Arts, either as practical men, inventors, or amateurs, that he executes orders for models of inventions and apparatus for experimental purposes; also in wheel and screw-cutting, ornamental, spiral, and general turning, and for optical, mathematical, and philosophical instruments, with precision, neatness, and economy.

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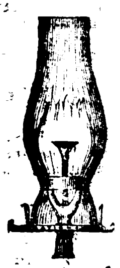
Gas.

A SHADOWLESS LIGHT WITHOUT SMOKE,



AT A SAVING OF UPWARDS OF 30 PER CENT., and no Alteration of Fittings required. Its cleanliness and purity essentially adapt it for Jewellers, Silversmiths, Drapers, and others; also Private Houses and Public Buildings. For Perfect Combustion, Brilliancy of Effect, Intensity, Power, and Economy of Light, THE NATIONAL ECONOMIC GAS BURNER bids fair to supersede every other burner in present use. The Inventors of the NATIONAL ECONOMIC GAS BURNER beg to submit it to the notice of the Public as one approaching nearer to perfection than any Burner yet invented. The following, among other Testimonials received from scientific individuals and the Press, warrant the Proprietors in asserting, that their Burner possesses the arrangements peculiarly favourable to Perfect Combustion; hence it is a fair inference that there must be "Economy of Light;" without either smoke or smell; in fact, Light is produced by the National Economic Burner in greater quantities, and of a better quality, than by any means heretofore known, and at a saving of from 30 to 40 per cent. As a proof of its "Power and Intensity of Light," one small burner will illuminate a room 24 feet square at the small sum of one half-penny per hour (London price of Gas.)

TESTIMONIALS AND OPINIONS OF THE PRESS.

From Dr. Ure.

I have examined the National Economic Gas Burner, and find it to possess three important features calculated to increase the light and lustre of gas flame; viz., 1. Preventing an undue supply of atmospheric air, which is apt to quench the combustion by its cooling effect; 2. Heating the gas before it reaches the orifices of the jets; 3. Reverberating the air, also heated, upon the burning gas. In consequence of these three points of improvement, ingeniously combined, the new burner is in my opinion preferable to any other which I have hitherto seen—both in operation and economy.

ANDREW URE, M.D., F.R.S., &c., &c.,
Professor of Chemistry, and Analytical Chemist.
13, Charlotte-street, Bedford-square,
April 6th, 1847.

From Isham Baggs, Esq.

(Patentee of several Important Inventions connected with Artificial Light, &c., &c.)

March 29, 1847.

Gentlemen,—I have made a trial of your National Economic Gas Burner, and have great pleasure in saying that for brilliancy, purity of flame, and of general applicability to the purpose of internal illumination, I have never yet seen it surpassed.

Yours truly,
To Messrs. Paul and Co. I. BAGGS.

MINING JOURNAL, March 20th, 1847.

The National Economic Gas Burner.—We have lately had an opportunity of testing the superiority of this new burner, which gives out a most brilliant light, perfectly white down to the lowest point of ignition, and which is, consequently, a sure test of the perfect combustion of the gas, the proceeds given off being merely the union of the oxygen of the air with the hydrogen, to form the vapour of water, and the carbon of the carburetted hydrogen forming carbonic acid. By the side of an Argand, a jet, or a bat's-wing, proceeding from the same double-branch, the effect is most striking, and clearly evinces the true philosophical, although simple, principles on which it is constructed.

MORNING HERALD, March 25th, 1847.

The National Economic Gas Burner.—A burner under this name has just been invented, which the patentees (Messrs. Paul and Co.) affirm obviates the defects peculiar to all ordinary burners, principally in the adoption of an apparatus which secures a more perfect combustion, and consequently a brighter and more homogeneous light, besides greatly economising the gas. The burner that has been submitted to us for inspection unquestionably shows a large surface of white flame, from which light of an extremely pure and intense character is emitted.

May be seen at the Society of Arts, the Institution of Civil Engineers, the Royal Polytechnic Institution, the various club houses at the West End, and many other public institutions throughout the United Kingdom.

Its consumption of gas has been carefully tested, and is proved as follows:—

No. 0 consumes 4 cubic feet per hour. This burner is well adapted for Halls, Staircases, Workrooms, and the interior of private houses generally.

No. 1 consumes 6 cubic feet per hour. This burner is well suited for general purposes.

No. 2 giving the light of three ordinary-sized Argands, consumes 9 cubic feet per hour. For lighting of Churches or Chapels, and Public Buildings, this burner is essentially adapted.

To enable the Public to judge for themselves of the accuracy of the above statement, an experimental meter of Croll and Glover's Patent is placed in a conspicuous part of the office, which will indicate the smallest quantity of gas consumed; therefore all parties desirous of testing this burner, are respectfully informed that it may be seen and tested from 11 till 4, at PAUL & Co.'s National Economic Gas Burner Office, 12, Leather-lane, Holborn.

To Engineers and Capitalists.

THE Proprietor of a very valuable Improvement in Machinery, whose engagements prevent his attending to the same, would be willing to dispose of his Patent right, upon very advantageous terms to the purchaser.

For particulars apply to D. C., 22, Waterloo-street, Birmingham.

Steam Engine.

Published this Day in 1 vol. Royal 12mo.,

Price 3s. 6d., Part 1, of

A SHORT TREATISE ON THE STEAM-ENGINE, adapted to the use of Schools, in which are given *Practical Rules for the use of Engineers*. By JAMES HANN, A.I. C.E. of King's College. Part 2, completing the work, in the press.

JOHN WEALE, 59, High Holborn.

Patent Carriages.

MESSRS. WHITEHURST and Co., have secured a license from Mr. Thompson, (the Patentee of the "AERIAL WHEELS,") to fit them to every description of carriage. These wheels give carriages a gentleness of motion quite unattainable by any kind of springs whatever. They entirely prevent the carriage making any noise; they prevent all jarring and jolting, and the draught is considerably less than common wheels, particularly on bad roads. Messrs. Whitehurst and Co. have fitted up a brougham with the "Aerial Wheels," in order that gentlemen desirous of trying them may have an opportunity of doing so.—313, Oxford-street, near Hanover-square.

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

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Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d*.; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

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Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs. T. Burnell and Co., 1, Great Winchester-street, London.

The Gutta Percha Company

INVITE the attention of Engineers, Machinists, Mill Owners, &c., to the PATENT GUTTA PERCHA DRIVING BANDS, which possess the valuable properties of great durability and strength, permanent elasticity, and uniformity of substance and thickness, thus avoiding all the irregularity of motion occasioned by piecings and inequality of thickness of leather straps. They are not affected by fixed Oils, Grease, Acids, Alkalies, Water, &c., and possess extraordinary facilities for being joined, and hug their work in a remarkable manner. Can be had of any width, substance, or length, without joints.

The Company continue to receive most satisfactory Testimonials of the superior quality of these Bands, which can be seen at the Company's Works, Wharf-road, City-road, where all orders will receive immediate attention.

E. GRANVILLE, Manager.

London, March 3, 1847.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

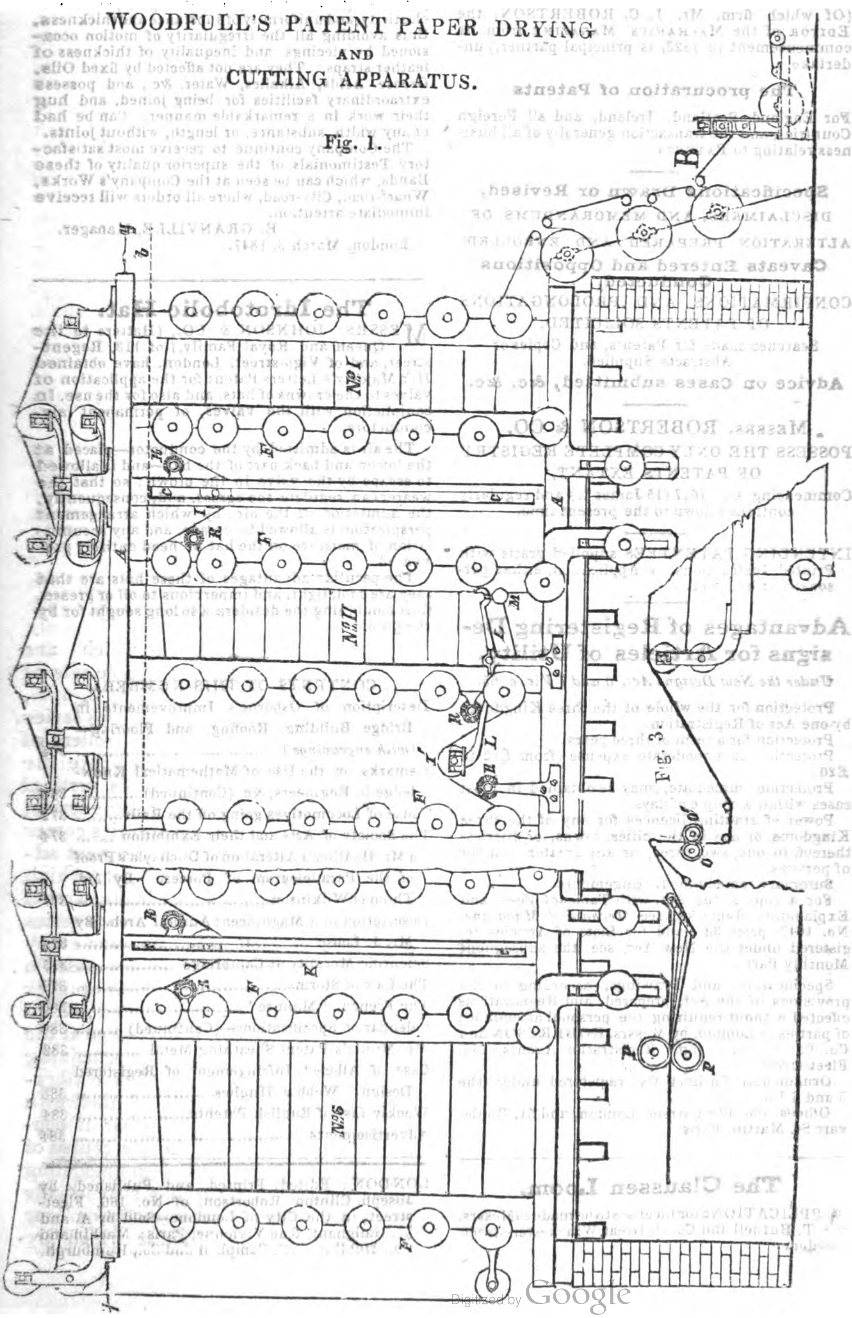
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1237.] SATURDAY, APRIL 24. [Price 3d.

Edited by J. C. Robertson, 166, Fleet-street.

WOODFULL'S PATENT PAPER DRYING AND CUTTING APPARATUS.

Fig. 1.



WOODFULL'S PATENT PAPER DRYING AND CUTTING APPARATUS.

[Patent dated October 8, 1846; Specification enrolled April 3, 1846. Patentee, Mr. Henry Woodfull, Footscray Mills, Kent.]

Fig. 2.

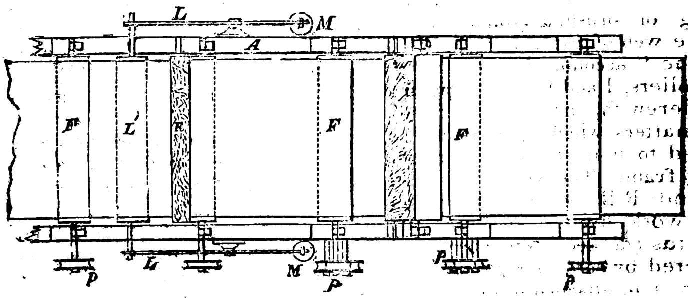
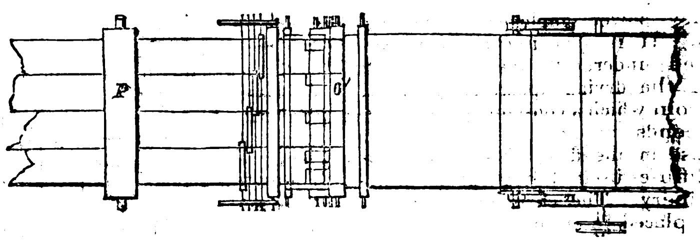


Fig. 4.



The manufacture of paper made a vast stride when the ingenuity of Didot enabled the maker to produce a web or sheet of unlimited length; but to enable him to reap the full advantage of that improvement, there yet remained one important thing to be done, and that was, to discover how it was possible to dry within the four walls of any building of moderate size the endless web as fast as it could be produced. Various systems of machinery have been proposed for this purpose, but none which comes at all up to the present for workmanlike skilfulness of arrangement, for the immense length of paper which can by means of it be put up to dry within any given cubical space, and for the property of self-adjustment which it possesses according to the ever-varying condition of the web in the course of drying.

Fig. 1 of the accompanying engravings represents a front elevation of this drying apparatus, and fig. 2 a plan of a portion thereof on the line *a b* of fig. 1.

A is a framework in which are mounted horizontally six double sets of revolving rollers F, Nos. 1, 2, 3, 4, 5, and 6. Every set consists of two series of six rollers each, and the rollers of each series are mounted one above the other and alternate as regards vertical position with those of the opposite series, so that every roller of each series comes opposite a blank space in the next adjoining series of the same set, which allows of the web of paper being carried alternately over and under the two series of rollers in each set. Between every two sets of rollers there is interposed a loose or vibratory roller, under or over which the web of paper is carried; three of these rollers, I I I, being placed at the top of the apparatus, and the remaining two, I' I', at the bottom. These vibratory rollers rise and fall of their own weight, according as the paper is contracted or lengthened in the course of drying, and from thus accommodating themselves to the varying state of the paper are called "accommodation" or "dancing" rollers. Those which are

marked I, slide up and down in the slots, *c c*, of the standards, K K, and those which are marked I′, are supported by oscillating levers, L L, which are counterpoised by weights M M; R R, are picking or brushing rollers, placed so that the web of paper as it passes to or from the "accommodation" or "dancing" rollers, I and I′, shall come in contact therewith, and be freed from any stray matters which may happen to be attached to it in its course through the drying frame. The whole of the rollers, F F and R R, are put in motion by wheel-work fixed at the back of the apparatus (not seen in the drawing) and connected by cords, straps, or bands, to pulleys, *p p*, attached to the ends of the said rollers; the wheelwork deriving its motion from the steam-engine, or other primary power employed on the premises. H is a heating chamber constructed underneath the apartment in which the drying apparatus is placed, and from which a constant supply of dry air ascends through holes made for the purpose in the floor of the apartment, and diffuses itself throughout the drying machinery. The chamber may have a stove placed in it, or it may have warm air conveyed into it by pipes from some other convenient source of supply. The horizontal rotary movements of the various parts of the machinery assist to produce a continuous upward current of warm air, and at the top of the apartment there are apertures made in the walls and roof to allow of the escape of the used air into the external atmosphere. B is a sizing-machine of the ordinary description.

The web of paper as it comes from this machine, is first passed over and under the two series of rollers of the set No. 1, then under the first of the "accommodation" or "dancing" rollers I, and thence down between the rollers of the set No. 2, in the same alternating order as before. And so the operation goes on throughout the entire series.

From the drying apparatus the paper is immediately carried under a series of circular cutters, marked O O. Figures 3 and 4, which divide it longitudinally into pieces of any required widths, and whence it is passed on between the glazing rollers, P P.

THE VALUE OF A CAMBRIDGE DEGREE AT WOOLWICH.

We referred in a foot note, at page 334, to a singularly illustrative example of the influence which is exercised by a Cambridge degree upon the fortunes of its possessor. Our able and much esteemed correspondent ("P. P.") thinks it "most extraordinary" that we should insinuate anything so monstrous as that "Cambridge men" are invariably pushed into positions by dint of barefaced partiality (p. 374). "If isolated cases," he says, "of partiality have occurred, by all means show them up (I believe I can guess that to which allusion is made, viz. the recent election at Woolwich); but such a general charge is most notoriously and egregiously without foundation;—if not, prove it." We must decline undertaking to prove what we never asserted; for the generality of our position went no farther than this, that the public of all classes have so blind and insensate a reverence for a mere "Cambridge degree," that Cambridge men are oftener promoted to posts of honour and responsibility, for having the degree, than for having those talents and acquirements for which alone degrees should be conferred. All this may be true, without involving "barefaced partiality;" it is simply a case of vulgar stupidity on the one hand, and of fortunate recipiency on the other. Our correspondent is right in his guess, that the recent election at Woolwich was the instance to which we alluded in our note, and we readily respond to his call upon us to "show it up." We have taken some trouble to ascertain the facts of the case, and believe the following statement of them will be found to be substantially correct in all its details. It will be seen, however, that the case is one of a mixed character, and that there were not wanting other motives besides the Cambridge leaning, for the extraordinary decision arrived at:

A few weeks ago, the veteran philosopher, Professor Barlow, was obliged, from failing health, to retire from his appointment in the Royal Military Academy. The practice in this institution (like that in the Ordnance service generally) is, that whenever an officer retires or is removed, all those subordinate to him are gradually promoted in the order of their official seniority, to fill the suc

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cession of vacancies so created. Room is thus made for a new appointment at the *bottom* of the list; and it is filled up according to the will and pleasure of the Master-general of the Ordnance for the time being. In some cases, when it was considered a matter of importance to the efficiency of the Royal Military Academy that the masters should be men of scientific reputation and known ability, the vacant post has been *offered* to men whose learning and talents were known and recognised in the country. In other cases, appointments have been made of persons totally unknown to the scientific world, as a matter of private arrangement. Latterly it has become the custom to submit *all candidates* to an examination, so as to ascertain their acquirements and tutorial views; which appears to be a return to the system which prevailed in Dr. Hutton's time. This, no doubt, *as a general rule*, is the most desirable course under the present system of inducements to enter into this department of the public service. For it is seldom that the discreditably low rate of salary which the Board of Ordnance has of late years given, will tempt any man of high talent and respectable acquirements to enter into such employment. The men who *now* offer themselves are, therefore, almost invariably of humble acquirements and still humbler abilities, both as mathematicians and teachers. When the object is to select from amongst men unknown by a single work, or even generally by a single contribution to the most elementary branches of science, an examination furnishes the only criterion of their relative fitness for the duties of the appointment. As to absolute fitness, it is almost out of the question, and does not seem estimated as of much moment by the Ordnance authorities of the present day; at least, it will so appear, if we judge by the facts before us.

The candidates who announced themselves on the recent occasion were either five or six, and they were ordered to appear before a "board of examiners" at Woolwich on the 5th ultimo. It appears, however, that only three presented themselves on that day. The "board" was composed of three persons:—

Major-General Parker, Lieut.-governor of the Royal Military Academy.

Mr. Airy, Astronomer Royal; and

Professor Christie, of the Royal Military Academy.

The three candidates were:—

1. Mr. Thomas Weddle, of Newcastle upon Tyne. This name is not new to our readers, nor to any one who is conversant with the present state of mathematical science. His method of solving numerical equations, of itself, will give his name to scientific history; and this is by no means his solitary discovery. His mathematical acquirements are most profound, and his powers and industry are such as to render him one of the most promising men of our day, and hence a most desirable acquisition in an institution such as the Royal Military Academy ought to be. His testimonials were also of a highly satisfactory character, but, with one solitary exception (Professor De Morgan's), they were none of them from Cambridge men; and Mr. Weddle himself is not a Cambridge man.

2. Mr. William Racster, M.A., of St. Peter's College, Cambridge, and mathematical master in a "proprietary school" at Blackheath. This gentleman "went in for honours" in 1838, and "came out" *seventy-eighth* on the list! He is to this hour, as far as we can learn, undistinguished by a single line contributed to the promotion of science, or even to the improvement of its processes. He was of Cambridge, however, and his testimonials were those of Cambridge men.

3. Mr. Carterfield, an usher in one of the well-known "cramming schools of Woolwich Common." Of his learning or fitness for the appointment, we know nothing; but we believe he is not a Cambridge man—and we suppose he was not able to bring much interest to bear upon his suit.

The result will have been mentally anticipated by our readers; but we apprehend that the special form of the circular letter addressed on the occasion to each candidate, will somewhat perplex our readers, as we confess it perplexes us. The following is an extract from it of all that bears upon our present comment.

Royal Military Academy,
Woolwich, March 11, 1847.

SIR,

The following is an extract from

the report of the Board assembled here on the 5th, by order of the Marquis of Anglesey, Master-General of the Ordnance, for the examination of the several candidates who offered themselves to fill the situation of mathematical master, about to become vacant by the retirement of Mr. Barlow; also the recommendation of the Board and decision of the Master-General on the subject:

"Each candidate was subjected to an hour's *vivâ voce* examination, and had a certain number of questions given him to solve; and they are now placed in the order in which the Board are of opinion their merits, as mathematicians, entitle them to stand:—

"1. Mr. Weddle.

"2. Mr. Racster.

"3. Mr. Carterfield.

"The Board consider that either of the first two of these gentlemen is well qualified to fulfil the duties of the situation for which they are candidates. They cannot, however, omit to remark that Mr. Rackster is, *in their judgment, the* MOST ELIGIBLE *of the two for the nature of the duties that will be required of him, and therefore recommend he should be nominated to fill the vacant situation*, of which Lord Anglesey, in his letter of the 10th, has approved.

* * * * * * * * * * *

"And remain, Sir,

"Your most obedient

"Humble servant,

"J. B. PARKER,

"Major-Gen. and Lieut.-Gov.

"To ———. "R. M. A.

Before criticising this extraordinary production, we would say a word or two on the composition of the Board from which it emanated. The gallant general at the head of it is one of the most straightforward and right principled men alive; but unfortunately he is no judge in scientific matters, and would have to take as gospel all that such men as Airy and Christie indoctrinated him with. Against the competency of the Astronomer Royal, there is of course nothing to be said; nor would there have been anything to say against that of Mr. Christie had the name of *Weddle* not been included in the list of candidates. From circumstances, however, well known to the whole of the mathematical world, a Christie was the last man in the world who should have sat in judgment on the merits of a Weddle. Had the authorities at the Ordnance-office but known as well as the "Fellows" at Somerset-house, the scientific relations of the two parties, they would never, assuredly, have included Mr. Christie in the commission of examination; and had Mr. Christie himself but possessed one atom of gentlemanly feeling, he would, on seeing that Mr. Weddle was a candidate, have instantly declined acting on the Board. Who, in mathematical circles can have forgotten that it was this same Mr. Christie who, in 1841, recommended the *suppression* of Mr. Weddle's celebrated method of solving numerical equations, which had been originally communicated to the Royal Society; and that he even claimed the prior discovery of the same method himself. What else could be expected than that he should shrink from being brought into daily contact—as he would have been by Weddle's election—with the man whom he had so deeply injured? Who so silly as to imagine that he would willingly tolerate so dangerous a rival near his "throne?"

To return to the official letter. The report of the Board, despite the predilections of the two Cambridge examiners, and the soreness in the mind of the one towards Mr. Weddle, confesses, that he was "*the best mathematician* of the candidates" (*how very far* the best is not specified), "and that he was *well qualified to fulfil the duties of the situation*." What greater fitness would they have? Surely scientific superiority with *all other* needful qualifications was a sufficient reason to decide in his favour at once! But no—"Mr. Racster is in their judgment the most *eligible* of the two for the nature of the duties required of him." Do they mean that he was the *best qualified?* If they did, why did they not say so? What are we to understand by such jargon as being "eligible for *the nature* of the duties?" Is it that the duties (which Weddle was "well-qualified to fulfil") are one thing, and "the nature" of them (for which Mr. Racster is "most eligible") another? Was ever greater nonsense penned? Or did ever superlative nonsense veil a more deliberate act of injustice?

Mr. Racster must have been wondrously titilated with his success, and not very scrupulously delicate in the display of his vanity when he sent such

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a paragraph as the following to the papers:—

"St. Peter's College.

"Racster, William, M A. (B.A. 1839), has been ELECTED *to succeed Professor Barlow* in the Woolwich Academy."—University Supplement to the *Cambridge Advertiser*, p. 216. March 31, 1847.

Successor to Barlow! Yes, in the same sense that the last commissioned ensign may dub himself successor to the general last deceased. Racster came in, as all new candidates do, at *the bottom;* and if he live long enough to see all above him in their graves, he may then call himself "successor to Professor Barlow"—but not till then.

En passant, we have made some inquiries respecting the mental calibre and scientific status of the Woolwich mathematicians. We find there are four out of the eight who are actually Cambridge men, and another who (being Professor Christie's "son and colleague") possesses the *esprit* of that university only in its most conventional form. Of these Cambridge men, Professor Christie and Mr. Heather are the only ones who have committed themselves in print, and both have commited themselves most abominably. (See *Mech. Mag.* vol. xliv. p. 289, and current vol. p. 224.) Mr. Heather we find was also of St. Peter's College, and number *forty nine in honours* of Racster's year. The fourth Cambridge man was of St. John's, and went out *forty fourth* of the οἱ πολλοι! *He* it is whom Mr. Racster has been really "*elected*" to succeed. What claim, then, if the appointments in the public service be rendered desirable for eminent men, have persons who ranked so low in honours at the university to such employment? What respect can the cadets entertain for such men, or what profit can they derive from such instructors? Or, again, what *love of science* are such men likely to create in the youthful mind, when it is evident that they do not themselves cherish a love of science *for its own sake*, nor possess the powers of mind necessary for its successful cultivation? So strongly are we convinced that such men *must be* despised by their pupils, that we confidently venture to deduce the conclusion that they *are* despised!

We have given, we think, sufficient reason for looking upon the appointment of Mr. Racster as a very questionable act, and calculated to justify grave suspicion—at a time too, when public attention has been so pointedly directed to the condition of this Institution, and therefore not likely to pass unobserved. We have, however, done with the affair; and shall now conclude by extracts from two letters written by resident and official Cambridge men of high standing in the University, and which have been placed in our hands by the gentlemen to whom they were respectively addressed:

"If I might express an opinion, I should confidently say, that no man whose position was lower than wrangler in the mathematical tripos, ought to be allowed to occupy an appointment in any institution where the mathematical sciences form the primary object of education. If a man read at all, and at length rise no higher than a senior or junior optime, we are disposed to regard such a one as a rash candidate for honours, as one whose talents are of a low order, or who has been idle, or perhaps vicious. A man of fair talent and steady reading, without overtaxing his powers of mind and body, may attain sufficient producible knowledge to be deemed worthy of a place amongst the wranglers."

Our extract from the second letter must be more copious:

"It is much to be lamented that a mere degree should have the extraordinary influence, of which you so justly complain, in procuring appointments for men unworthy of them, and incapable of fulfilling the duties with credit to themselves or usefulness to the public. This is felt as a great evil by the respectable members of the university: but it is one which I fear admits of no remedy, whilst the public is determined to accept our degree as an evidence of superior learning. I have always observed that those who have the *least* personal claim to distinction for their acquirements are always the most ostentatious in the parade of their degree, and most noisy in their declamation against all other scholars who (much to their credit) have risen to scientific or literary distinction without having enjoyed the superior advantages which our men do.

"As your questions have an obvious bearing upon the Royal Academy at Woolwich, I will simply express my own thoughts on the adaptation of our course of studies to that institution. I know nothing of its constitution—little of its professors, *except* a few by their writings—and my judgment of its course of studies must wholly be formed from its authorized text-books. There can be no doubt on one point: that the objects of that institution are entirely of a practical and professional character, and

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that, to be rendered useful, its course of studies must be materially different from our own, both as regards their general character and particular details. I should think, too, that a different character of mind from that slow and contemplative habit which it is the special tendency of exclusive and earnest mathematical study to produce, would be an essential condition to be aimed at in military education, and that mathematical science would only be cultivated in immediate reference to the special military application of which it was susceptible. Neat and commodious formulæ, sufficiently approximative for practical uses, readiness and precision in calculation, and great facility in the manner of applying the formulæ to the cases that arise: these, I should think likely to be the main purposes that would be aimed at, since, as far as mere boys are concerned (the cadets, I believe, *finish* their academic life at 17 or 18), such are the only ones that seem capable of being efficiently cultivated. I take it for granted, that the investigations of the formulæ are insisted on; and I think, that Dr. Hutton's course contains generally all that is required for military purposes of this kind. The later editions, however, I am told, are much improved and modernized; and though I have not seen the latest, I often hear men speak of it in very favourable terms.

* * * *

"Now, if there be one class of tuition for which one system of training would altogether unfit a man, I should consider it to be such a one as this. Our system is so entirely contrasted with a military course of study, as to convince me, that however eminent a man may be at the university, he would find himself in so new a world, and requiring such essentially different habits of mind, that his position would be most embarrassing. I should sincerely pity such a man. As to the poll-men and men in low honours, since they could not distinguish themselves in the University, with all the facilities and advantages for study which they had here, it would be an utter absurdity to suppose they would be more successful elsewhere—except on the principle that 'amongst the blind, the one-eyed are kings.' This, indeed, I suppose to be the principle on which is founded the exaggerated estimate that the public form of the men who parade and advertize our degrees, as evidence of their claim to be considered scientific and literary prodigies. I should not, however, suppose it likely that this class of men would stand the slightest, even an infinitesimal chance of getting into the Woolwich Academy. That branch of the public service must require men of a much more practical turn of mind than it is the tendency of our system to produce in our men; for the government will not be imposed upon, however much private speculators in schools may be, by such shallow pretences."

The writer of this letter will now see how far his confidence in the wisdom of "the government" is misplaced. He appreciates the character of the mass of the men of his university properly; and he takes a good practical common-sense view of the probable duties of an appointment at Woolwich; but he little dreams of the "fantastic tricks" that are so constantly played off in the name and under the easily-obtained sanction of the government, by a host of intriguing and selfish official underlings—and that through every department of the public service.

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

(Continued from page 372.)

There are also the same fallacies possible in mathematical processes as in any other: the same "symbol" may be inadvertently used in different significations, just as the same "word" may in non-mathematical argument. A result may be attributed to a wrong cause, or cause and effect confounded in a long train of analytical investigation—just as similar errors may occur elsewhere. It is true, this seldom happens in comparison with other sciences; but the liability to error must be constantly guarded against by the student, as an occurrence not at all impossible. As an example of a very common fallacy, which has been committed to a very serious extent by even great mathematicians, may be mentioned the confounding two distinct meanings of the symbol (=), one of which is "*arithmetical equality*," the other, "*symbolical equivalence*," as nearly as common language can express them; which two meanings are perfectly distinct. There are two remarks in Professor De Morgan's "Differential Calculus" which will illustrate what I am referring to: "I think Legendre has very obviously fallen into this misconception; but it has led him to no false results. Indeed, it is obvious that confounding, 'A may be written for B' with 'A is equal to B,' though it must affect the logic, may not affect the result of a process." In another place he has noticed another fallacy, viz., the supposing that

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because "A results from B," it cannot result from "*anything else but B.*"

No blind reverence and submission is therefore to be paid to a process, merely because it is an algebraical or analytical one. But, on the other hand, the student must not throw aside as useless, or reject as nonsense, even those theorems which he may suspect to be fallacious, and for this reason, that what may be fallacious when *one* meaning is attributed to the symbols (either by author or reader), may become perfectly true and satisfactory when *another* meaning is attributed to them. Now, this attributing of wrong meanings, is one of the commonest sources of difficulty to the reader, and sometimes of error in the author. One of the first points, therefore, to be settled is, the signification of the terms or symbols used. When the reader sees two or more meanings, and is confused between them, he must take each, in order to try whether that will give an intelligible process. And here may perhaps be the proper place, to notice one source of confusion which lies at the root of one half the difficulties usually encountered, viz., *the utter misconception of what the quantities are which the mathematician deals with*, or, in other words, *the confounding things themselves with those other and merely abstract magnitudes used to measure them and compare one with another*. For example, it is not uncommon for the beginner in dynamics to go half through a treatise, or even through a good many, without attaching any definite, or, at any rate, correct notion to the letters F, P, *f*, &c., used to denote the forces reasoned about. If it be an attracting force, he very likely conceives the P or F to stand for a magnet, or some *occult quality* in the magnet; and, truly, to him it is "occult" enough: Aristotle's were nothing to it. If F or P is stated by the author to "denote the force of attraction of a planet, &c.," it is the planet, or some occult influence in the planet, which he somehow associates with this letter P or F, and a precious jumble he makes of the matter. In statics the same notions are just as common, but not productive of the same confusion and mischief, because he has, from daily experience, acquired unconsciously, something which almost supplies the place of a formally admitted and distinct notion. Thus, while he still represents to himself the meaning of P, Q, H, &c. by the actual bodies, such as a mass of iron, &c, instead of by the NUMBER of pounds or the RATIOS of such numbers, he nevertheless has a much more sensible notion of the reasoning than in dynamics. Even in pure mathematics, where there is comparatively so little room for such misconceptions, he is not free from them. Thus he confounds the "angle" of Euclid with the analytical angle; and wherever he sees θ, ϕ, &c. instead of a *ratio*, he thinks about an *opening*. There is a sad deficiency of explanation of these fundamental steps in most writers on these subjects. But a really sound mathematician, who is writing for the purpose of giving his readers some common-sense information, will not omit such observations. As an instance of this I may mention Airy, who begins his masterly "Treatise on Gravitation" by such requisite preliminary explanations: another instance of this anxiety in the same writer to make the reader remember what he is about, occurs in a note to his tract on the "Figure of the Earth." If once a firm and deeply-rooted conviction be felt (which, however, can perhaps only be obtained by *experience*), that all mathematical processes are to be judged of by the same common sense as any other reasonings, and that the symbolical language in which they are conducted, though of infinite value as an *assistant* to the memory and reason, does not the less render them amenable to the same supreme tribunal as the commonest and least dignified subject—if this be once attained, I say, it will be ever afterwards a safeguard against that irrational and unphilosophical submission to half understood propositions, which goes so far to mystify the student, and prevent his advancement in science. The aphorism of Bacon may be applied to this subject as well as to the study of nature:—"Homo, naturæ minister et interpres, tantum facit et intelligit quantum de naturæ ordine re vel mente observaverit; nec amplius scit aut potest:" or, changing a few words in Sir John Herschel's translation, "Analysis, as the minister and interpreter of reason, is limited in process and result by its conformity to reason; neither its evidence nor its results extend further."

The misconception of the real use of analysis has been exposed by Poinsot in several places. In his Memoire sur "L'Equateur du Systeme Solaire," the

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following passage occurs:—"Cet exemple nous fait sentir toute l'importance qu'on doit attacher aux notions primitives et aux vrais principes des choses; *car le calcul n'est qu'un instrument, qui ne produit rien par lui-même, et qui ne rend en quelque sorte que les idées qu'on lui confie.* Si nous n'avons que des notions imparfaites, ou si l'esprit ne regarde la question que d'un point de vue borné, ni l'analyse ni le calcul ne lui apporteront plus de lumière, et ne donneront à nos resultats plus de justesse ou plus d'étendue: au contraire, on peut dire que cet art de réaliser en quelque sorte par le calcul, de fausses on de vagues conceptions, n'est propre qu'à rendre l'erreur plus durable en lui donnant pour ainsi dire, une sorte de consistance."

For some further observations—explaining the cause of these erroneous views as to the real province of analysis—I must refer to another Memoire, "Theoriè Nouvelle de la Rotation des Corps," which deserves the most considerate attention, as the opinion of one who has spent a long life in *thinking* and establishing principles, instead of mere dabbling amongst analytical artifices. Of course, the *principles* of *analysis* require as deep and patient thought as the principles of mechanics, and are, no doubt, still more difficult; but there is all the difference in the world between him whose claim to mathematical honours rests merely on the application of principles (often little more than a mere mechanical operation), and another, who places fundamental principles on a sound and clear basis; for, when this is accomplished, the application is easy enough.

I shall make one extract from the Memoire:—

"C'est un nouvel exemple qui montre l'avantage de cette méthode simple et naturelle de considerer les choses en elles-mêmes, et sans les perdre de vue dans le cours du raisonnement; car, si l'on se contente, comme on le fait d'ordinaire, de traduire les problèmes en equations, et qu'on s'en rapporte ensuite aux transformations du calcul pour mettre au jour la solution qu'on a en vue, on trouvera le plus souvent que cette solution est encore plus cachée dans ces symboles analytiques, qu'elle ne l'était dans la nature même de la question proposée. Ce n'est donc point dans le calcul que reside cet art qui nous fait decouvrir, mais dans cette consideration attentive des choses, où l'esprit cherche avant tout à s'en faire une idée, en essayant, par l'analyse proprement dite, de les decomposer en d'autres plus simples, afin de les revoir ensuite comme si elles étaient formées par la réunion de ces choses simples dont il a une pleine connaissance. * * * .. Ainsi notre vraie methode n'est que cet heureux mélange de l'analyse et de la synthèse, où le calcul n'est employé, que comme un instrument: instrument précieux et necessaire sans doute, parce qu'il assure et facilite notre marche; mais qui n'a par lui-même aucune vertu propre; qui ne dirige point l'esprit, mais que l'esprit doit diriger comme tout autre instrument." "Ce qui a pu faire illusion à quelques esprits sur cette espece de force qu'ils supposent aux formules de l'analyse, c'est qu'on en retire, avec assez de facilité, des verités déjà connues, et qu'on y a, pour ainsi dire, soi-même introduites; et il semble alors que l'analyse nous donne ce qu'elle ne fait que nous rendre dans un autre langage."

Instances of this "extracting from Analysis that which we put in," are found in most writers. Such expressions as this, after a long row of equations: "*Hence* we see, &c." "*This shows* us that &c.;" when all that is "seen" and "shown" by these equations is generally something as clear as daylight of itself, or very obvious before the equations were manufactured. This solemn manner of arriving at truisms, this much ado about nothing, this killing a gnat by a cannon ball, reminds one of Hudibras's "telling the clock by algebra," or the mountains in labour bringing forth "ridiculus mus." What, for instance, can be greater humbug and tomfoolery than to enunciate formally, and then attempt to *prove (!)* mathematically, that if the vertical line through the centre of gravity fall without the base the body will tumble over? Not content with this, we must have a long string of corollaries, in one of which a grand secret is disclosed, the result of all this profound gabble, viz.: the "explanation of how difficult it is to balance a body upon a *point* placed immediately under its centre of gravity"!! Blessings on their learning! Here is something worth communicating *pro bono publico*. Imagine the author to go up to a little urchin trying to stand or walk along some railings, "My dear child, after much cogitation, and by the aid of a

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very powerful analysis, I have arrived at this theorem, that if you attempt to stand bolt upright on this spike, which approximates, as you observe, practically to a *point*, you will infallibly topple over, *because*, &c. &c.; and it might not be difficult to derive as a corollary to the laws of percussion—if proper data be given of the elasticity of your noddle and the height of the railings—that you will be more or less smashed." Now, really this is not one whit more ridiculous than the "conclusions," and even "practical suggestions" to which grave authors sometimes arrive. No doubt, some of these absurdities have contributed to bring the whole subject into contempt with practical men, when they see so very little wool after so very great a crying.

I have dwelt longer on the subject of "The Rise and Abuse" of Analysis than may appear necessary; but those who know how much depends on correct views of this point, and how few students there are who do anything more than "juggle" with it, especially in attempting the solution of problems, will acknowledge its full importance. For example, a problem in analytical geometry is tried—a locus is to be found; well, instead of *thinking* carefully about the geometrical conditions of the case, and merely using the transformation of the equations *with a definite view*, he begins by writing down this equation, and that equation, and everything that he can think of, and hopes by some lucky shuffling and dodging to get at the result. He may be fortunate enough in some instances to do this — generally after immense toil and waste of time, and by a complex and inelegant method. This is, indeed, a branch of analysis in which there is more room for chance solutions and effecting a thing by lucky choice of co-ordinate axes, &c., &c., than in any other; but it is still far from being so dependant on chance as students imagine; and at any rate they have no ground for expecting to fall in with these "lucky hits" if they have not attentively considered the problem before applying their algebra. In mechanical problems, however, there is scarcely anything that depends on chance—nothing but a clear conception of the whole of the forces acting, &c., &c., will ever lead to the solution. "Rein ne nous dispense," as Poinsot says, "d'etudier les choses en elles mêmes, et de nous bien rendre compte des idées qui font l'objet de nos speculations." Indeed, it is this preliminary "consideration of things in themselves," which constitutes the whole difficulty nearly of every problem of every science. Most students soon acquire sufficient *mechanical dexterity* in handling the algebra, the trigonometry, the differential calculus, the integral calculus, &c., to render the part which depends merely on such transformations a simple exercise of the pen and ink. And yet it is to this low and subordinate part which they are most eager to hurry—for this simple reason, that it costs them no thought, and is, in fact, a mere amusement dignified by a grand name.

It is, indeed, a very pleasing relief to the mind, and as it were the reward of one's labour; but it is a very great mistake to fancy that we have *learnt* anything from all this portion — often, indeed, by far the *greater bulk* of the solution. Take, for instance, the lunar theory; supposing the student to know the principles from which the equations of motion are derived, what intellectual exercise is there in the long and wearisome process of integrations and approximations, which constitute the great bulk of the treatises on this subject? If the reader were to attempt to perform these integrations *by head*, without using his pen, then, indeed, he would have to think hard enough, and very soon get inextricably confused and distracted; such an effort of thought would, moreover, be exceedingly absurd, and a mere waste of time and energy, inasmuch as the writing down each step relieves the mind without injuring the reasoning; and is, in fact, the only possible way of managing such calculations. But when he has got through this merely mechanical operation, and comes to the physical and common-sense *interpretation* of his analytical results—when he has to "explain the effect of the various terms" of these equations, showing how one is connected with the motion of the moon's perigee, another with the eccentricity of her orbit, &c., &c.; then he has to *think*, and the dry and lifeless mass of formulæ is found to be full of real, tangible, commonsense meaning, and the task of interpretation is a thoroughly intellectual one, and the only part which deserves to be called "profound."

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We impose upon ourselves by words. We give the appellation of "profound analysis" to a long study of differential equations, integrations, &c., &c.—which might almost be as well done by Babbage's machine—and we forget that the only "profundity" is in that part which requires patient and intense thought. We cajole ourselves by fine words, and very often writers mislead their readers also, so as to give them the bare rind and bark to admire, whilst the pith and heart of the whole is neglected; I refer to some historians of science, and not to the writers of treatises on the subject. I am persuaded that the real merits of many great men have been thus mistaken and wrongly appreciated.

(*To be continued.*)

CAUSES OF LOCOMOTIVES GOING OFF THE RAILS.

Sir,—As my remarks in your last number may be misunderstood, from the want of any reasons given for the opinion there expressed, I beg to trouble you with a few additional observations.

Theoretically speaking, the force applied perpendicularly to one crank, would produce the same effect on *both* wheels. The writers on mechanics, in fact, suppose the power and resistance to act in the same plane without altering the effect (in the "wheel and axle," when treated as one of the mechanical powers, and also in this very case of the locomotive axle and cranks). This, indeed, always assumed, that all the forces, tending to produce rotation, may be brought into the same plane, without altering the effects, either on the equilibrium or motion of the body on which they act. But, in reality, I believe that not only must the *twisting* tendency be taken into account (that form which does, in fact, produce the well-known crystalline form and magnetic properties in axles of locomotives), but what is of more importance to our present question, the rotatory motion is not communicated from one crank to *both* wheels *in the same time*. That a certain time is required for the transmission of force in all bodies, is well known: a stick, for instance, suspended by its middle, may, by a blow, have one end knocked off without moving the other, provided it be done quick enough. Now, when the velocity of locomotives is considered, the time required for the transmission of the rotary force from the crank to the wheels, may be productive of effects not sensible in other less rapid motions. Not that the time required depends on the velocity of the engine, but the *effects* of the *difference* of time in reaching the two wheels, may be, and are, I think, by no means to be neglected.

It is not, then, a mathematical question that we are dealing with, and cannot be solved by mere theoretical calculations. It is for this reason that I wished to know if it had been "inquired into experimentally."

If one axle did not serve for both wheels—if each crank, in fact, was connected only with its own wheel—then the effects of the rectangular position of the cranks would be enormous, and carry the engine off the line very soon, and at very low velocities.

The effects of want of accurate "balancing" of all the parts—by a defect of which the same force would, for instance, send one side of the engine on faster than the other, and so produce similar results to those now considered—have been amply shown by an engineer of Birmingham (Mr. Heaton, I think), about two years ago; and I believe several railway companies put their engines into his hands for inspection as to this point.

I may just mention, in conclusion, that I have heard it said, with reference to the necessity of having the cranks at right angles, in order to carry the engine beyond the "dead point," that, in stationary engines, there is the fly-wheel to do this; but is there not in locomotives a moving mass of 15 tons or so, with a velocity such that the whole momentum is very much greater than in any stationary engine and its fly-wheel? If so, there is no more need of right-angled cranks in one than the other.

Upon the whole, I feel satisfied that an experimental investigation ought to be made, and have a strong suspicion that it would lead to their abandonment.

Yours respectfully,

A. H.

IMPROVED MODE OF ATTACHING CLOCK PENDULUMS.

Sir,—Every one has noticed that the pendulum of a common Dutch clock

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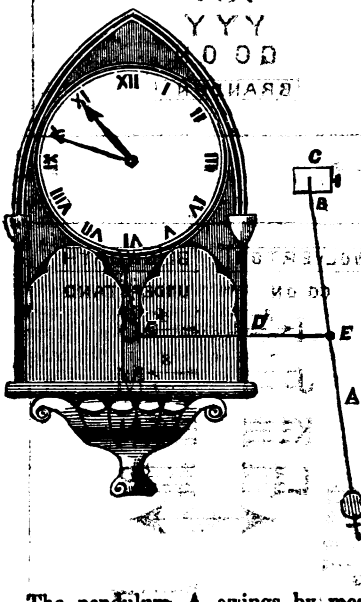
swings through an aperture in the bottom of the case, which aperture is made of a considerable size to enable the pendulum to swing to its full extent.

Now, it is obvious that the dust must rise through this aperture and settle on the works of the clock, which not only has the effect of stopping its motion in a short time, but also mixes with the oil and engenders a gritty substance, which soon wears out the works.

I have remedied this defect in a very simple manner, by placing the pendulum *outside* the clock instead of *inside*, forming a connection with the works by means of a connecting-rod, which has a horizontal motion, passing through a small hole in the side of the clock; the operation of which will be easily understood by referring to the following figure:



The pendulum, A, swings by means of the elasticity of a spring at B, attached to a square piece of wood fastened to the wall at C, alongside the clock. A connecting rod, seen at D, is attached to the pendulum at E, which passes through a small aperture in the side of the clock, and is attached to the works at F. The two rods A and F, therefore, swing together, the pendulum A communicating its motion to F, while F communicates its power to A, and thus a uniform motion is kept up, the advantage of which contrivance is that a large open space in the clock case is abolished, and a small hole in the side substituted, at no additional expense.

I do not propose this as a matter of theory, but one of fact, having constructed a common clock on this principle which keeps regular time.

I am, Sir, yours, &c.,

JOHN N. FENNINGS.

2, Park-place, Stoke Newington,
February 2, 1847.

DESCRIPTION OF SEVERAL IMPROVED ELECTRO-TELEGRAPHIC INSTRUMENTS INVENTED BY WILLIAM HENRY FRENCH, OF CARDIFF, LATE TUTOR TO THE ELECTRIC TELEGRAPH COMPANY, STRAND, LONDON.

(Continued from page 280*.)

Improved Dial Plate.

The facility of communication by electric telegraph greatly depends on a judicious arrangement of the signals on the dial, the want of which is fully apparent in Cooke and Wheatstone's double-needle telegraph, which may be seen from the complication of its signals and their uncertainty of signification, arising from the varying method of indication and their indiscriminate use for both letters and figures, some of which are indicated by direct, and others by vibratory or opposite, movements. In addition to the above objections, the signals are rendered very uncertain from the omission of three letters of the alphabet, and, consequently, from the double meaning of three others used as substitutes. The letters omitted are J, Q, and Z—their substitutes are G, K, and S. The transmission of any one of these letters is always attended with great uncertainty and loss of time, as also the signals indicating the letters which are used as substitutes for figures, the difference of which is only known by

* In the electro-magnetic bell arrangement, page 280, instead of "every successive increment of power" (which was a typographical error), read "every secession of power, as by every successive increment of power." The soft iron within the coils is rendered magnetic, by means of which the escape of the mechanism is liberated, and the bell rings; but at each secession of power, the soft iron resumes its natural state of demagnetization, which will allow the keeper to recede, and detain the escapement, thereby stopping the bell, the uncertainty of which has hitherto been a source of great annoyance.

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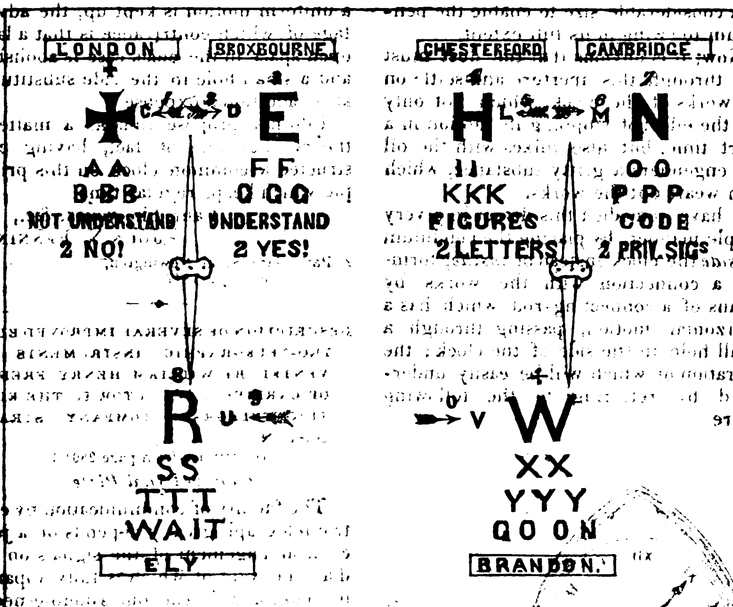
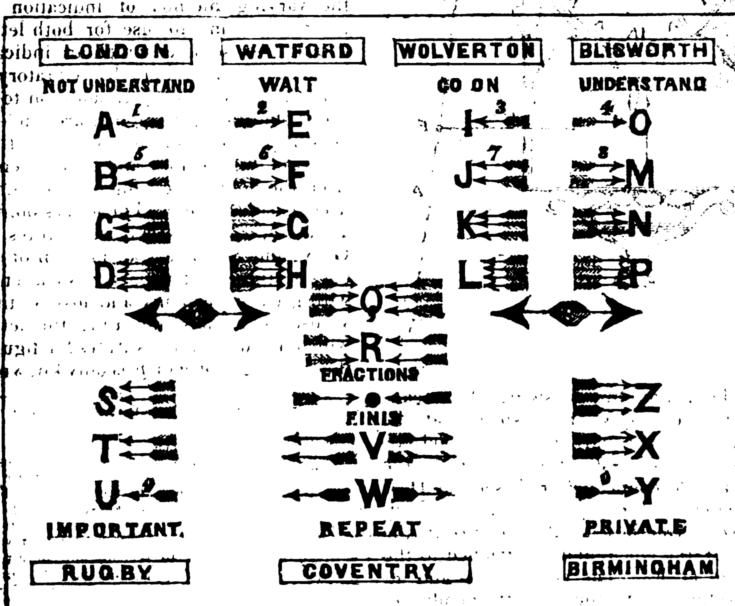
COOKE AND WHEATSTONE'S PLAN.

Fig. 1.



FRENCH'S PLAN.

Fig. 2.



the use of preparatory signals, which are often misunderstood, and consequently obliged to be repeated many times. The preparatory signal used for a change from letters to figures is the letter H, when followed by the + (stop). This signal must be repeated by the recipient, before the figure should be given by the communicator. After the figures are given and acknowledged, the communicator must give another preparatory signal, which must be repeated by the recipient before the communicator can return to letters. The preparatory signal for a return to letters is the letter I, when followed by the + (stop). From the great uncertainty attending the double and sometimes three-fold meaning of the letters used as substitutes for figures, and from the loss of time in giving their preparatory signals, many of the clerks will not use the numerals, because many of their correspondents are unable to understand them; they therefore prefer spelling each figure, in order to ensure an understanding, although at a considerable expense of time.

The want of alphabetical order in the dial of Messrs. Cooke and Wheatstone, is also another objection, which has given rise to many questions as to where each letter stood, even by those who could send almost any kind of communication; yet, in consequence of the lack of order, they were for a considerable time unable even to receive the simplest communication. The complicated indications and signals—their uncertainty of signification—the omission of three letters of the alphabet—the substitution of three others, and the want of alphabetical order—are evils which have ever perplexed the most advanced of my pupils. The evil of substituting one letter for another may be seen from the following fact:

It was to the strenuous exertion and ability of Thomas Home, Esq., the late licensee of the electric telegraph on the Great Western Railway, that the public were principally indebted for the detection of Tawell for the murder at Salt Hill; but had the telegraph been in less intelligent hands the result might have been very different: for the suspected person was described as being dressed in the the garb of a *Quaker*, and from the letter K being substituted for the letter Q, this important word became changed into KUAKER—a difference which might have naturally induced doubt and hesitation, and led to requests for explanation, which would have caused a serious delay, and perhaps led to the defeat of justice. I have known many important words obliged to be repeated many times on this account, especially names of persons and places. This evil having been felt to a very great extent, has lately induced the Electric Telegraph Company to introduce on the Dial Plate two of the three letters omitted, namely, the letters Q and Z, which are indicated by a converge and diverge movement; the introduction of which has only increased the complication of the apparatus—the signals being now indicated by (1) direct, (2) by vibrating or opposite movements, and by (3) converge, and (4) diverge, movements. When both needles moved they used to refer to the signals at the bottom of the dial only, but now, by the letter Q being placed at the top of the dial, they refer to the top also; thus making it still more complicated. The letter J is still omitted, and causes ever-recurring confusion and mistakes, occasioned by such substitutions as *Games* for *James*, *Gay* for *Jay*, &c.

It must now be obvious, that to avoid these evils telegraphic communication can only be carried on with the entire use of the alphabet; and that it is also needful to have an immediate and unobstructed recourse to numerals whenever they happen to be interspersed in a literal communication, especially in government dispatches, bank robberies, and other like urgent cases.

I have yet to state another objection to the existing apparatus—namely, the false signals occasioned by the oscillation of the needle, the signals being indicated by the dip of the needle. To obviate this, I intend that the signals in fig. 2 shall be indicated by the bodily movement of the pointers. The mechanical arrangements will be explained in a future number, but it may be here observed, that the dial, fig. 2, is also applicable to the mechanical arrangements of the instruments now in use.

All the above objections are effectually obviated by the use of my plan, fig. 2, which embraces the whole of the alphabet arranged in alphabetical order, with two exceptions, displaced with the view of making the vowels more readily seen, and also to facilitate the indication of

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each vowel by one movement only. By my plan the letters of the alphabet and the numerals have each their own specific indication; the letters are also indicated by directive movements only; and the numerals by vibrating or opposite movements only, thereby precluding the necessity of using preparatory signals for a change from letters to figures, and for returning from figures to letters.

By a comparison of both plans, it will be readily seen that my plan, fig. 2, is much simpler, more certain, and expeditious:

The Vowels.

By the old plan, fig. 1.

The vowels in fig. 1, are indicated by thirteen movements, and obscurely scattered on the face of the dial, consequently, they are frequently omitted.

By the improved plan, fig. 2.

The vowels in fig. 2 are indicated by seven movements only, or one movement for each vowel, and so disposed on the face of the dial as to be readily seen. Their omission by this plan will not be required.

EXPLANATION OF BOTH DIALS.

The Alphabet.

By the Old Plan, Fig. 1.

The letter A is indicated by two movements of the left-hand needle to the left.

B, by three movements of the left-hand needle to the left.

C, by two movements of the left-hand needle, first right, then left; which indicates fig. 1 also.

D, by two movements of the left-hand needle, first left, then right; which indicates fig. 2 also.

E, by one movement of the left-hand needle to the right, indicating fig. 3 also.

F, by two movements of the left hand needle to the right.

G, by three movements of the left-hand needle to the right.

H, by one movement of the right-hand needle to the left. This movement has three distinct indications: when followed by the stop it means (1) the letter H, (2) the preparatory signal for figures, and (3) the figure 4. The writer defies the most experienced signalizer to distinguish, without a repetition, whether the above signal is intended for the initial H, the preparatory signal for figures, or the figure 4. I have many times known this signal when indicating the initial H, or the figure 4, to be mistaken for the preparatory signal for figures.

I, by two movements of the right-hand needle to the left.

J is omitted, for which G is used as a substitute.

K, by three movements of the right-hand needle to the left.

L, by two movements of the right-hand needle, first right, then left.

M, by two movements of the right-hand needle, first left, then right.

N, by one movement of the right-hand needle to the right.

By the Improved Plan, Fig. 2.

The letter A is indicated by one movement of the left-hand pointer to the left.

B, by two movements of the left-hand pointer to the left.

C, by three movements of the left-hand pointer to the left; no other indication connected with these movements.

D, by four movements of the left-hand pointer to the left; no other indication connected with these movements.

E, in the same manner as fig. 1; but no other indication by this movement.

F, in the same manner as fig. 1.

G, in the same manner as fig. 1.

H, by four movements of the left-hand pointer to the right. Four movements for a signal may be objected to; but how much better is it to have one movement more, with certainty, than for a letter to have so many significations, attended with uncertainty?

I, by one movement of the right-hand pointer to the left.

J, by two movements of the right-hand pointer to the left.

K, in the same manner as fig. 1.

L, by four movements of the right-hand pointer to the left.

M, by two movements of the right-hand pointer to the right.

N, by three movements of the right-hand pointer to the right.

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O, by two movements of the right-hand needle to the right.

P, by three movements of the right-hand needle to the right.

Q is omitted, for which K is substituted.

R, by one parallel movement of both needles to the left.

S, by two parallel movements of needles to the left.

T, by three parallel movements of both needles to the left.

U, by two parallel movements of both needles, first right, then left.

V, by two parallel movements of both needles, first left, then right.

W, by one parallel movement of both needles to the right.

X, by two parallel movements of both needles to the right.

Y, by three parallel movements of both needles to the right.

Z is omitted, for which the letter S is substituted, which is indicated by two parallel movements of both needles to the left.

+ (the stop) is indicated by one movement of the left-hand needle to the left; the stop is also used as not understand; the understand is indicated in like manner as the letter E.

O, by one movement of the right-hand pointer to the right.

P, by four movements of the right-hand pointer to the right.

Q, by three movements of both pointers inwards.

R, by two movements of both pointers inwards.

S, by three movements of both pointers to the left.

T, by two movements of both pointers to the left.

U, by one movement of both pointers to the left.

V, by two movements of both pointers outwards.

W, by one movement of both pointers outwards.

X, by two movements of both pointers to the right.

Y, by one movement of both pointers to the right.

Z is indicated by three movements of both pointers to the right; no omission or substitution by this plan.

+ (the stop) is indicated by one movement of both pointers inwards. The "not understand" is indicated the same as the letter A, which persons would naturally use. The "understand" is indicated in like manner as the letter O, which would also be naturally used.

The Numerals.

To indicate Numerals in Fig. 1.

The prefaced signals, H and the stop, are required, which must also be concluded by the prefaced signals, I and stop, for a return to letters.

Figure 1 is indicated in the like manner as the letter C when followed by the letter H and stop, which must be acknowledged in the same manner by the recipient before the signal indicating the figure 1 can be given.

2 is indicated in like manner as the letter D when followed by the letter H and stop, twice repeated.

3 in like manner as the letter E when followed by H and stop twice repeated.

4 in like manner as the letter H, when followed by the same letter H and stop twice repeated.

5 in like manner as the letter L, when followed by the letter H and stop twice repeated.

6 in like manner as the letter M, when followed by the letter H and stop twice repeated.

7 in like manner as the letter N, when followed by H and stop twice repeated.

8 in like manner as the letter R, when followed by H and stop twice repeated.

To indicate numerals, or letters following numerals in fig. 2, prefaced signals are not required, as each numeral has its own specific indication, which is far more certain and expeditious.

Fig. 1 is indicated by two movements of the left-hand pointer, first right and then left. Prefaced signals not required.

2, by four movements of the left-hand pointers, thus—right, left, right, left.

3, by two movements of the left-hand pointer, first left, then right.

4, by four movements of the left-hand pointer, thus—left, right, left, right.

5, by two movements of the right-hand pointer, first right, then left.

6, by four movements of the right-hand pointer, thus—right, left, right, left.

7, by two movements of the right-hand pointer, first left, then right.

8, by four movements of the right-hand pointer, thus—left, right, left, right.

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9 in like manner as the letter U when followed by the stop twice repeated.

The cypher is indicated in like manner as the letter V, when followed by the H and stop twice repeated.

The fractional signal is indicated in like manner as the letter W.

9, by one movement of both pointers to the left.

The cypher is indicated by one movement of both pointers to the right.

The fractional signals are indicated in like manner as the letter R.

(*To be continued.*)

MILLWARD'S IMPROVEMENTS IN PRODUCING FIGURED SURFACES, SUNKEN AND IN RELIEF.

[Patent dated 15th Oct., 1846; Specification enrolled 15th April, 1847.]

Although many attempts have been made to apply the modern discovery of electric precipitation to the production of figured surfaces (apart from the gilding or coating of such surfaces), none of them can boast of much practical usefulness. From Mr. Millward's specification it would seem as if the prevailing cause of failure had been the placing of too much or too sole a reliance on the electric agency. He proposes to combine that agency in various ingenious ways with other known processes; and we may say of his plans generally, that they present at least great likelihood of success. The following descriptions are extracted from his specification:—

To produce, *firstly*, sunken figures or designs in metallic surfaces, the patentee proceeds as follows: He first paints or draws, or otherwise depicts the design or figure, on the metallic surface that is to be ornamented, or imprints that design or figure upon it by stencilling or transferring. He then precipitates, by any of the known and approved modes of precipitating metals by the agency of voltaic electricity, a thin coating of gold, or silver, or copper, or any other metal readily precipitable by such agency, which deposits itself evenly on all parts of the surface, excepting those only which have been covered by the figure or design, or, in other words, stopped out; or he produces such coating by any other known means (preferring, however, the process of precipitation). He next clears away the colouring or other materials which have been employed in the stopping out, and brings the surface into connection with the negative pole of a voltaic battery or electro-magnetic machine, employing with the battery or machine such a solution as will act only on the metal of the ground-plate, whereby all those parts of that plate which were covered by the stopping out, but have been removed as last directed, may be decomposed or sunken to any extent required. Or instead of employing a voltaic battery or electro-magnetic machine for the purpose, he immerses the metallic surface in any acid or alkaline, or other saline solution capable of acting on the exposed portions of the surface, but not on the precipitated metal. The sunken figure or design may be intersected in different parts by cross lines in relief, so as to exhibit the appearance of what is called cross-hatching, by inserting such lines with a pencil dipped in varnish before subjecting the plate (after it has been cleared of the stopping out) to the action of the galvanic battery or electro-magnetic machine, or acid, or alkaline, or other saline solution as aforesaid.

Secondly, The patentee also produces sunken figures or designs in metallic surfaces in manner following: He first covers the whole of the surface by any of the processes aforesaid with a coating of any suitable metal; he next does the coating over with varnish, and then scrapes out the figure or design in the varnish; after which he exposes the surface to the action of the negative pole of a voltaic battery or magnetic machine, or immerses it in a suitable acid, or alkaline, or other saline solution, each as aforesaid, whereby the metal left *exposed* by the scraping-out process is decomposed and removed, and the sunken figure or design produced; taking care always to use such an acid, or alkaline, or saline solution only as will act on the ground-plate, and not on the precipitated metal.

Thirdly, He produces figures in relief in manner following: He first deposits, by any of the means aforesaid, on the surface of metal to be ornamented, a coating of *any* suitable metal, and then paints, or draws, or otherwise depicts on the deposited metal, the figure or design which he wishes to appear in relief, or imprints the same upon it by stencilling or transferring. He next intersects this figure or design by indented lines and cross lines, after the well-known manner of line engraving, clearing away from such lines and cross lines the whole of the colour or other materials employed in laying on the figure or design. (But this last part of the process may be dispensed with where the figure or design is not required to be very minutely worked out.) He then connects the plate with the negative

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pole of a voltaic battery or electro-magnetic machine, or immerses it in an acid, or alkaline, or other saline solution, each as aforesaid, whereby the whole of the parts of the deposited metal which are left exposed are decomposed and removed, and the lines of the desired figure or design only left standing in relief. Care must, of course, be taken, as in the processes first hereinbefore described, that such solutions only are used with the voltaic battery or electro-magnetic machine as will hold the metal in solution which is intended to be dissolved; and that such acids, or alkaline, or other solutions only are employed as will not act on the deposited or superimposed metal.

Fourthly, He produces figures or designs in relief on metallic surfaces by the following modification of the process last described: He first varnishes the surface or ground plate all over, and then scrapes out the figure or design in the varnish. He next deposits on the parts of the ground plate from which the varnish has been thus removed, a coating of any suitable metal, after which he removes from the plate all the remainder of the varnish; he then subjects the plate to the action of the negative pole of a voltaic battery or magnetic machine, or of an acid, or alkaline, or other saline solution, each as aforesaid, using such acid, or alkaline, or other saline solutions only as will act on the ground plate, and not on the superimposed and protecting metal, and employing with the battery or machine such solutions only as will hold in solution the metal desired to be decomposed.

Fifthly, He produces figures or designs in metals which partake of the character of being both sunken and in relief, and are commonly designated as "pierced work," in the manner following: He superimposes, by electric deposition or otherwise, on a plate of any metal, a thin coating of any suitable metal, and paints or otherwise depicts, on the superimposed coating of metal, the intended figure or design. He then exposes all the parts, save those laying immediately under the figure or design, to the action of the negative pole of a voltaic battery or electro-magnetic machine till the said parts are completely corroded and dissolved through and through (both ground plate and superimposed coating). Or, instead thereof, he immerses the plate in an acid, or alkaline, or other saline solution, till the like effect is produced. The colour or other materials employed in laying on the figure or design may be afterwards cleared away if required.

Sixthly, He also produces "pierced work" in manner following: He takes a metal plate, on which a raised figure or design has been stamped out, and covers it all over, as well at back as in front, with a deposit of any suitable metal produced by the agency of voltaic electricity as aforesaid; he now removes, by means of a scraper or other suitable tool, the deposited metal from those parts which he wishes to pierce through, after which he exposes the plate to the action of the negative pole of a voltaic battery or electro-magnetic machine, using therewith such a solution as will act only on the original plate, and not on the deposited metal, whereby all the parts from which the deposited metal has been removed are decomposed; or, instead of subjecting the plate to the action of the voltaic battery or electro-magnetic machine, he immerses it in an acid, or alkaline, or other saline solution as aforesaid, using for the purpose such an acid, or alkaline, or other saline solution as will act only on the metal to be decomposed. Another mode of effecting the same object is as follows: He takes a sharp cutter, and cuts through the metal deposited on the front of the plate all round the figure or design, whereupon so much of the deposited metal as covered the design drops out; he then subjects the plate to the action of the negative pole of a voltaic battery, or magnetic apparatus, or acid, or alkaline, or other saline solution, each as before, and thereby dissolves all those parts from which the deposited metal has been removed, employing only such acid, or alkaline, or other saline solution as will act on the metal of the ground plate, but not on the deposited metal. Instead of employing a coating of metal as the stopping out material in the preceding processes, any suitable varnish may be used, but he prefers the metal, as being less liable to injury.

Seventhly, Where articles with figured or plain surfaces have been manufactured by ordinary processes, such as stamping, embossing, or casting, and it is desired to matten or deaden the whole, or certain parts thereof, he effects this by first covering the surface desired to be mattened or deadened with varnish, or any other suitable medium, and then precipitates on the article, by electric deposition as aforesaid, a coating of any suitable metal. He next clears away the varnish or other coating, and connects the article with the negative pole of a voltaic battery or magnetic machine, using therewith such a solution as will not act upon the precipitated metal; or, instead thereof, he immerses the article in an acid, or alkaline, or other saline solution as aforesaid, using such solutions as will only act on the metal intended to be decomposed. A like effect may be produced by at once stopping out all the parts but those desired to be deadened or mattened,

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and then connecting or immersing as aforesaid.

Eighthly, and lastly, He produces, in manner following, engraved surfaces, sunken and relief, from which impressions may be afterwards taken on paper, cloth, or any other suitable material by any of the modes of printing or embossing in ordinary use. If the figure or design is to be sunk in, he first paints, or otherwise depicts, the figure or design upon a plate or other surface of metal, and then deposits on the uncovered parts a thin coating of any other suitable metal by the agency of voltaic electricity, or otherwise, as aforesaid; he next clears away the colour or other material employed in making the figure or design, and immerses the plate or other surface in an acid, or alkaline, or other saline solution, whereby the parts of the metal now left exposed, and which were those previously covered by the paint or other material employed to depict the figure or design, may be decomposed, and removed to any depth required, taking care, as before, to use such solutions as will act only on the metal desired to be decomposed. If the figure or design is to be in relief, he first deposits on the plate or other surface of metal a coating of any suitable metal by the agency of voltaic electricity or otherwise, as aforesaid, and then paints or otherwise depicts the figure or design on the deposited metal, after which he subjects the plate or other surface to the action of the negative pole of a voltaic battery, or electro-magnetic machine, or immerses it in an acid, alkaline, or other saline solution, each as aforesaid, whereby the deposited metal on all those parts not covered by the figure or design are decomposed and removed, and the figure or design is left standing out in strong and clear relief.

THE AURORAL ARCH OF MARCH 19.

The Rev. Temple Chevallier in a communication to the *Athenæum* states that he has collated the various published accounts of the auroral arch seen by our correspondent, Mr. Loose, and described by him in our Journal of the 17th inst., and computed its mean height to be 177 miles. He adds:

"There is one circumstance respecting auroral arches, which does not appear to have been distinctly noticed as a general fact. *They have all a motion from north to south magnetically*. This motion is particularly mentioned in the account of the auroral arch of March 29, 1826, by Mr. Dalton, in the *Phil. Transactions* for 1838, Part I., p. 293. In the same paper, p. 300, a similar motion is mentioned in an arch seen at Mount Stewart in Scotland and elsewhere, Oct. 17, 1818; and in one seen at Kendal, Dec. 27, 1827. A motion of the same kind is noticed by Capt. Smith in his *Cycle of Celestial Objects*, vol. i. p. 167, respecting a luminous arch observed by him September 29, 1828. I have myself observed the same kind of motion in an auroral arch seen at Durham and elsewhere on the 22nd of March, 1841,—particularly described in the *Athenæum* of May 1, 1841 (No. 705, p. 340); and the same southerly motion was observed in the late auroral arch. This motion, observed at Cambridge, seems to have been through about 10°, or from 67° of altitude to 57°, between 8h. 50m. and 9h. 10m.: which implies a rate of motion of above 100 miles an hour. But this motion appears, from the different descriptions, to have been very irregular. In all probability, this southerly drifting motion is closely connected with the cause which produces the arch;—and it seems likely that the late discoveries of Faraday, showing that magnetism produces in almost all bodies a tendency to arrange themselves in a direction at right angles to that of the usual magnetic influence, may furnish the means of explaining the hitherto mysterious nature of these striking phenomena.

THE GUN-COTTON—IMPORTANT EXPERIMENTS.

Having been informed that some important experiments were to be made this week on a part of the Syston and Peterborough Railway, near Stamford, to test the value of the gun-cotton for blasting purposes, as compared with gunpowder, we applied to Messrs. John Hall and Son (the eminent gunpowder manufacturers), who are the managing proprietors of the gun-cotton patent, for a statement of the results, and have been most promptly and obligingly favoured by them with copies of the following documents. The experiments seem to establish, incontestably, that, for blasting purposes, the gun-cotton is superior to gunpowder in the proportion of not less than six to one:—

Stamford Hotel, Stamford,
April 21st, 1847.

Messrs. John Hall & Son:

Gentlemen,

I beg to enclose you my report on blasting gun-cotton against gunpowder in the Geeson cutting, now making for the

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Syston and Peterborough Railway, near Stamford.

The several experiments were conducted with every principle of fairness, in the presence of Mr. Grafton, Mr. Birnie, the resident engineer of that portion of the line, and several gentlemen living in the neighbourhood.

I wish to remark, in placing these trials before you in a tabular form, that the cutting in which these trials were made, is through a hard freestone foundation. The entire depth of the cutting at this part is about 28 feet, the upper portion of which is composed of clay and a loose rubble, under which lay beds of freestone varying in thickness. The thickness of the layer upon which these experiments were made, is about five feet. It was greatly to be regretted that the character of the ground was such as not to allow me to test the powers of gun-cotton on a more extensive scale. You will see that they are all small charges; still the results were most satisfactory to all persons present, and none were more convinced of its superiority over gunpowder than the men engaged upon the work. The cubical quantity of the stone heaved and removed by the several explosions was, in many instances, estimated by Mr. Birnie, the engineer present, who took a very lively interest in the matter, and who appeared highly gratified at the advantages derivable from the use of gun-cotton in all operations where blasting is essential.

These experiments show that the average powers of the patent gun-cotton in blasting is proved to be in the proportion of one of gun-cotton to six of gunpowder; so that, where six holes are necessary when powder is used, only one hole is necessary when the gun-cotton is substituted, whereby a great saving of time, labour, and expense in all blasting operations, whether in open cuttings, tunnels, or deep mines, is effected, and proves the invention of gun-cotton to be invaluable.

I am, gentlemen,

Your obedient servant,

JOHN F. WHEELER.

TABLE.

No. of Expert.	Proportion.	Weight of Gun-cotton in Ounces.	Weight of Gunpowder in Ounces.	Depth of Hole.	Diameter of Hole.	No. of Cubic ft. of Stone removed	Weight of the Stone Removed.
						Cubic ft.	
1	4 to 1	....	8 ozs.	3 ft.	2 ins.	80	6 tons.
2	1 to 4	Loose, 2 ozs.	....	3 ft.	2 ,,	125	10 tons nearly.
3	1 to 4	Loose, 2 ozs.	....	2 ft. 9 ins.	2 ,,	106	8 tons.
4	1 to 2	In paper tube 4 ozs.	....	3 ft. 9 ins.	2 ,,	320	24 tons nearly.
5	1 to 2½	Tube, 3 ozs.	....	3 ft.	1½ ,,	180	14 tons.
6	8 to 1 nearly	....	11 ozs.	1 ft. 8 ins.	1½ ,,	40	3 tons.
7	1 to 8	In paper tube 1½ oz.	....	1 ft. 8 ins.	1½ ,,	34	2½ tons.
8	......	Loose, 1 oz.	....	1 ft.	1½ ,,	19	1½ tons.
9	......	Loose, 1 oz.	....	1 ft.	1½ ,,	......	....
10	......	Loose, 1 oz.	....	1 ft.	1½ ,,	......	....

The above proportions of gunpowder and gun-cotton were tried in the Geeson cutting, near Stamford, being a part of the Syston and Peterborough line now in progress.

April 20, 1847.

JOHN F. WHEELER.

STEAM-SHIP BUILDING ON THE THAMES.

Messrs. Miller, Ravenhill, and Co., have nearly completed a new steamer, called the *New Star*, designed by Mr. Pascoe, the naval architect to that firm (of whom we may say in passing, without flattery, that he has not many equals for taste and skill in the department of construction to which he has devoted himself), which is intended for the London and Gravesend station, and which they have bound themselves by contract shall run the distance *in fifteen minutes less time than it was ever done before*:

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Another notable instance of a similar spirit of daring in our river builders has been just furnished by Messrs. Ditchburn and Mare. A vessel, called *The Prince Metternich*, of 600 tons, has been built by them, under a contract with the Danube Steam Navigation Company, that it shall, with 150 tons of dead weight, not draw in any part more than six feet of water, and shall realize an *average* speed of at least "fifteen British miles per hour, as the said miles are measured on the river Thames." The vessel was tried last week on the river, and not only was the draught less by 2½ ins., but the speed greater by three-quarters of a mile, than stipulated for! So confident were the contractors in the accuracy of their calculations, that they had actually engaged to forfeit 3,200*l*. if her draught exceeded the six feet by only six inches, and another sum of 3000*l*. if her speed was one mile less than 15 miles per hour.

It is a pity that government do not fall upon some similar plan of ensuring a correspondence between the calculated and the actual capabilities of their ships. Such a thing as a vessel of the Royal Navy drawing less water or doing more work than has been expected from her, scarcely ever happens—indeed, we do not recollect an instance of the sort; while instances of egregious failure are of such every-day occurrence as to tempt one to ask, whether it would not be just as well to do away in Her Majesty's dockyards with mould-lofts and calculation altogether?

STEAM-SHIP BUILDING ON THE MERSEY.

The best of the steamboats hitherto plying between Liverpool and Dublin have taken commonly from 10 to 12 hours to perform the voyage. But a new boat, called the *Minerva*, has just been built by Messrs. Bury, Curtis, and Kennedy, of 130 tons, and 365 horses power, which has accomplished the passage in 8 h. 48 m., with a pretty strong head-wind all the way from Holyhead to Dublin.

The same firm have another boat building for the Chester and Holyhead Company, which they confidently expect will run 19 miles per hour.

LIST OF ENGLISH PATENTS GRANTED FROM APRIL 17 TO APRIL 20, 1847.

George Holworthy Palmer, of Surrey-square, Old Kent-road, civil engineer, for an improved method or mode of producing inflammable gasses of greater purity and higher illuminating power than those in use; and also in the arrangement of the apparatus employed for the purpose, and which apparatus may be applied to other similar purposes. April 17; six months.

Joseph Woods, of Bucklersbury, engineer, for certain improvements in springs for supporting heavy bodies, and resisting sudden and continuous pressure. (Being a communication.) April 20; six months.

John Fisher, the younger, of Radford-works, Nottingham, mechanician, for improvements in arranging or folding certain narrow fabrics. April 20; six months.

Samuel Kenrick, of Handsworth, Stafford, iron master, for certain improvements in preparing or forming moulds for casting metal. April 20; six months.

George William Rowley, of Welbeck-street, Cavendish-square, gentleman, for improvements in the construction of carriages, and in apparatus to be used with omnibuses and other carriages. April 20; six months.

Thomas Brown, of Muscovy-court, Tower-hill, London, agent, for improvements in machinery for raising and lowering weights. (Being a communication.) April 20; six months.

Osman Giddy, of Hereford-lodge, Old Brompton, gentleman, for improvements in apparatus for sweeping or cleansing chimneys and flues. April 20; six months.

Philip Burnard Ayres, of Howland-street, Fitzroy-square, doctor of medicine, for certain plans and improvements in preparing putrescent organic matters, such as night soil, the matter in suspension in the water of sewers, and other similar matters, for the purpose of manure, or for other purposes; and for apparatus for the same. April 20; four months.

John Walker, of Crooked-lane, London, engineer, for improvements in certain hydraulic and pneumatic machines, and in the application of steam or other power thereto. April 20; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 3RD OF FEBRUARY TO THE 22ND OF MARCH, 1847.

William Eaton, of Camberwell, engineer, for improvements in machinery for twisting cotton or other fibrous substances. February 23.

Alfred Krupp, principal of the house of Frederick Krupp, of Essen, Prussia, but now of Leicester-square, Middlesex, for certain improvements in the manufacture of spoons, forks, and other similar wares, and in the machinery or apparatus employed therein, parts of which are also applicable to other manufacturing processes. February 24.

William George Armstrong, of Newcastle-upon-Tyne, Esq., for an improved lifting, lowering, and hauling apparatus. February 25.

Charles Barlow, of Chancery-lane, Middlesex, gentleman, for a new apparatus and arrangement of machinery to be used in collecting the contents of sewers, drains, and cesspools, and also treating the mass so collected in such a manner as to render the same applicable to agricultural and other useful purposes. (Being a communication from abroad.) February 26.

Thomas Hutchison, of Paisley, salesman, for a machine for constructing patterns in stripes, checks, and tartans for woven and other fabrics. Feb. 26.

Pierre Armand Le Comte de Fontainemoreau, of 15, New Broad-street, City, for certain improvements in the machines for the manufacture of bricks, and other plastic products. (Being a communication from abroad.) March 2.

Andrew Crosse, of Broomfield, in the county of Somerset, esquire, for improvements in treating fermentable, and other liquids, so as to cause impurities or matters to be extracted or precipitated. March 4.

François Stanilas Meldon de Sussex, of Millwall, Middlesex, manufacturing chemist, for improvements in the manufacture of chlorine hydro chloric acid, and nitric acid, and obtaining several products therefrom. March 4.

(To be concluded in our next.)

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LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
March 20	1015	Samuel Beddows, & Samuel Twist	Birmingham	Bagatelle table.
27	1016	Hyam Brothers	Bristol, Manchester, London, &c.	Overcoat.
,,	1017	Peter Gammon	Birmingham	Chest of drawers.
,,	1018	Samuel Varley	Sheffield, surgeons' instrument cutler	Portable railway fire escape.
29	1019	Charles White, Geo Lister Haynes, & Charles Bevis	Back Church-lane, Whitechapel	Capstan.
,,	1020	Charles White, Geo. Lister, Haynes, & Charles Bevis	Ditto Ditto	Windlass.
31	1021	Thomas Crump	Derby, gas engineer	Purifying gas burner
"	1022	William Sanderson	Carver-street, Sheffield	Balance handle for knives and forks.
April 1	1023	E. and B. Latchford	Saint Martin's-lane, London, bit, stirrup, & spur makers	Albert bit
3	1024	John Ward	Lille, France, Machanist	Heckle for heckling fibrous materials.
,,	1025	Joseph Bunnett	Lombard-st., London, engineer.	Revolving wood shutter
6	1026	George Wallis	Sidmouth-st., Gray's-Inn-road, London	Perforated and embossed zink (for gig and coach work).
,,	1027	George Hadfield	The Seacombe varnish and colour works, Cheshire	Design for securing key or case.
7	1028	Harriet Sinclair	Fountain-place, City-road	Elastic bonnet and capstand.
,,	1029	G. Dixon Haley. M. D.	Bedford	Inhaler.
,,	1030	James Isod & James Walter Baseley	Wheatsheaf-yard, Farringdon-street, roller manufacturers	Sealing-wax folder.
8	1031	Felix Abate	London, civil engineer and architect	Self-acting hydrostatic valve for sewers, drains, &c.
,,	1032	James Parkes & Son	St. Mary's-row, Birmingham	Illuminated night clock.
,,	1033	John Whitehouse and Son	8, Birchall-street. Birmingham, brass-founders	Bell lever.
10	1034	Benjamin Biram	Wentworth	Miner's safety lamp.
,,	1035	Robert Bowie	1, Fowke's - buildings, Great Tower-street, London, surgeon	Glass ventilating pane.
,,	1036	Harry Morris	Chancery-lane	Shirt.
12	1037	Cowley and James	Walsall. Stafford	Steam cock.
15	1038	Henry Ward	Northampton, surgeon	Ether inhaler.
,,	1039	Alfred Augustus De Reginald Hely	Manchester buildings, Westminster	Flexible floating cylinder, applicable to the construction of life rafts, floats, &c., for the preservation of life, &c., from shipwrecks, &c.
17	1040	George Ritchie	Skinner-street. Snow-hill	Spirit lamp.
,,	1041	Henry Mitchell	Regent-street	Hat ventilator.
19	1042	Alexander Miller	Lothian-street, Edinburgh, saddler and harness-maker	Fuel save-all, and dust consumer.
20	1043	David Manton	Wellington - street, Newington-causeway	Railway signal lamp.
,,	1044	Benjamin Brown	Strand, London	Telegraph for omnibuses.

Advertisements.

To Engineers, Whitesmiths, &c.

A Steady Respectable Man of Twenty Years' Experience as a Practical Mechanist, wants employment as a superintending or working foreman. He is well acquainted with Gas Fitting, and perfectly conversant with every branch of his business, and can give undoubted reference as to his capability and integrity.

Address, A. B., Mr. Jeffrey's, Sun-street, Bishopsgate.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters-Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

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Gas.

A SHADOWLESS LIGHT WITHOUT SMOKE,

AT A SAVING OF UPWARDS OF 30 PER CENT., and no Alteration of Fittings required. Its cleanliness and purity essentially adapt it for Jewellers, Silversmiths, Drapers, and others; also Private Houses and Public Buildings. For Perfect Combustion, Brilliancy of Effect, Intensity, Power, and Economy of Light, THE NATIONAL ECONOMIC GAS BURNER bids fair to supersede every other burner in present use. The Inventors of the NATIONAL ECONOMIC GAS BURNER beg to submit it to the notice of the Public as one approaching nearer to perfection than any Burner yet invented. The following, among other Testimonials received from scientific individuals and the Press, warrant the Proprietors in asserting, that their Burner possesses the arrangements peculiarly favourable to Perfect Combustion; hence it is a fair inference that there must be "Economy of Light," without either smoke or smell; in fact, Light is produced by the National Economic Burner in greater quantities, and of a better quality, than by any means heretofore known, and at a saving of from 30 to 40 per cent. As a proof of its "Power and Intensity of Light," one small burner will illuminate a room 24 feet square at the small sum of one half-penny per hour (London price of Gas.)

TESTIMONIALS AND OPINIONS OF THE PRESS.

From Dr. Ure.

I have examined the National Economic Gas Burner, and find it to possess three important features calculated to increase the light and lustre of gas flame; viz., 1. Preventing an undue supply of atmospheric air, which is apt to quench the combustion by its cooling effect; 2. Heating the gas before it reaches the orifices of the jets; 3. Reverberating the air, also heated, upon the burning gas. In consequence of these three points of improvement, ingeniously combined, the new burner is in my opinion preferable to any other which I have hitherto seen, both in operation and economy.

ANDREW URE, M.D., F.R.S., &c., &c., Professor of Chemistry, and Analytical Chemist.
13, Charlotte-street, Bedford-square,
April 6th, 1847.

From Isham Baggs, Esq.,
(Patentee of several Important Inventions connected with Artificial Light, &c., &c.)

March 29, 1847.

Gentlemen,—I have made a trial of your National Economic Gas Burner, and have great pleasure in saying that for brilliancy, purity of flame, and of general applicability to the purpose of internal illumination, I have never yet seen it surpassed.

Yours truly,
To Messrs. Paul and Co. I. BAGGS.

MINING JOURNAL, March 20th, 1847.

The National Economic Gas Burner.—We have lately had an opportunity of testing the superiority of this new burner, which gives out a most brilliant light, perfectly white down to the lowest point of ignition, and which is, consequently, a sure test of the perfect combustion of the gas, the proceeds given off being merely the union of the oxygen of the air with the hydrogen, to form the vapour of water, and the carbon of the carburetted hydrogen forming carbonic acid. By the side of an Argand, a jet, or a bat's-wing, proceeding from the same double branch, the effect is most striking, and clearly evinces the true philosophical, although simple, principles on which it is constructed.

MORNING HERALD, March 25th, 1847.

The National Economic Gas Burner.—A burner under this name has just been invented, which the patentees (Messrs. Paul and Co.) affirm obviates the defects peculiar to all ordinary burners, principally in the adoption of an apparatus which secures a more perfect combustion, and consequently a brighter and more homogeneous light, besides greatly economising the gas. The burner that has been submitted to us for inspection unquestionably shows a large surface of white flame, from which light of an extremely pure and intense character is emitted.

May be seen at the Society of Arts, the Institution of Civil Engineers, the Royal Polytechnic Institution, the various club-houses at the West End, and many other public institutions throughout the United Kingdom.

Its consumption of gas has been carefully tested, and is proved as follows:—

No. 0 consumes 4 cubic feet per hour. This burner is well adapted for Halls, Staircases, Workrooms, and the interior of private houses generally.

No. 1 consumes 6 cubic feet per hour. This burner is well suited for general purposes.

No. 2 giving the light of three ordinary-sized Argands, consumes 9 cubic feet per hour. For lighting of Churches or Chapels, and Public Buildings, this burner is essentially adapted.

To enable the Public to judge for themselves of the accuracy of the above statement, an experimental meter of Croll and Glover's Patent is placed in a conspicuous part of the office, which will indicate the smallest quantity of gas consumed; therefore all parties desirous of testing this burner, are respectfully informed that it may be seen and tested from 11 till 4, at PAUL & Co.'s National Economic Gas Burner Office, 12, Leather-lane, Holborn.

To Engineers and Capitalists.

THE Proprietor of a very valuable Improvement in Machinery, whose engagements prevent his attending to the same, would be willing to dispose of his Patent right, upon very advantageous terms to the purchaser.

For particulars apply to D. C., 22, Waterloo-street, Birmingham.

To Mechanics and Scientific Institutions, &c.

For Sale,

A COMPLETE Electric Apparatus, a 2 feet plate and 13 inches cylinder, both uncommon and nicely fitted up.

An Electro-Magnetic apparatus, &c. A collection of Scientific and Medical Books. A Set of 3 Lecturing Tables and 3 Forms, and everything connected with Science.

The Proprietor is about leaving London for the Country or Continent, would be glad to be employed by any Institution.

Apply by letter only to Mr. E. French, 14, James-street, Covent Garden.

To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

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Birkbeck Course of Practical Chemistry.

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FIFTEEN LESSONS of Two Hours Each, at a Reduced Fee, for persons practically engaged in Manufactures; the Course will include the most important ordinary operations of the Laboratory, Chemical Manipulation, Preparations, Quantitative and Qualitative Analysis. The instruction will be given by Mr. Campbell, demonstrator, under the direction of Professor Fownes, on Mondays and Thursdays, from Seven to Nine, p.m., commencing on the 10th of May. Fee, including the cost of materials, £2.

HENRY MALDEN,
Dean of the Faculty of Arts.
CHARLES C. ATKINSON,
Secretary to the Council.

April 21, 1847.

The Forester.

A PUBLIC Advertising Journal of Weekly News. Price 5d. No. 116, Saturday, April 24, contains all the Political and Commercial Intelligence of the week, together with detailed Notices of the Theatres, &c., &c.

Published every Saturday, at the Office, 13, Salisbury-square, Fleet-street, and may be had of all News Agents in Town and Country.

Patent Carriages.

MESSRS. WHITEHURST and Co. have secured a license from Mr. Thompson, (the Patentee of the "AERIAL WHEELS,") to fit them to every description of carriage. These wheels give carriages a gentleness of motion quite unattainable by any kind of springs whatever. They entirely prevent the carriage making any noise; they prevent all jarring and jolting, and the draught is considerably less than common wheels, particularly on bad roads. Messrs. Whitehurst and Co. have fitted up a brougham with the "Aerial Wheels," in order that gentlemen desirous of trying them may have an opportunity of doing so.—313, Oxford-street, near Hanover-square.

NOTICES TO CORRESPONDENTS.

The Electric Telegraph.—*Messrs. Brett and Co.'s system is exceedingly ingenious, but that as well as all other systems, is about to be so entirely thrown into the shade by the new plan which Mr. Bain has lately secured by patent, as to make it superfluous to inquire as to its merits. What are 250 letters a minute to* 1000! *What is all that has been done on either side of the Atlantic compared with this? We think we are in a position to promise our readers that they shall be among the very first to be informed of all the details of this very extraordinary invention.*

"A Patent Proprietor."—*It is impossible for any journal to give the specifications of* all *the patents that are taken out; and it is a fraud in any journal to pretend to do so; neither are all of them by any means worthy of notice. We give such as the public are most likely to take an interest in; and almost always before any of our contemporaries.*

Crampton's Locomotive "Namur."—*N. will find a very good account of this engine in the* Railway Record *of April 10. It is a six wheeled one, and of the enormous weight, when running, of 22 tons. The chief objection which we have heard made to it is that the consumption of fuel is excessive.*

H. R. (Nottingham) could not sustain a patent for his invention after obtaining a medal for it from the Society of Arts, or any other public body.

Z. (Norwich.)—We are not aware of any patent being taken out in this country for Howe's machine.

Professor Davies's letter reached us, unfortunately, at too late a period of the week for insertion in this Number; but it shall appear in our next.

Communications received from Agricola—R. V.—A Bristolian—A Tutor—S. R. V.—Audi alteram partem—Alfred—D. N.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W.C. Campbell and Co., Hamburgh.

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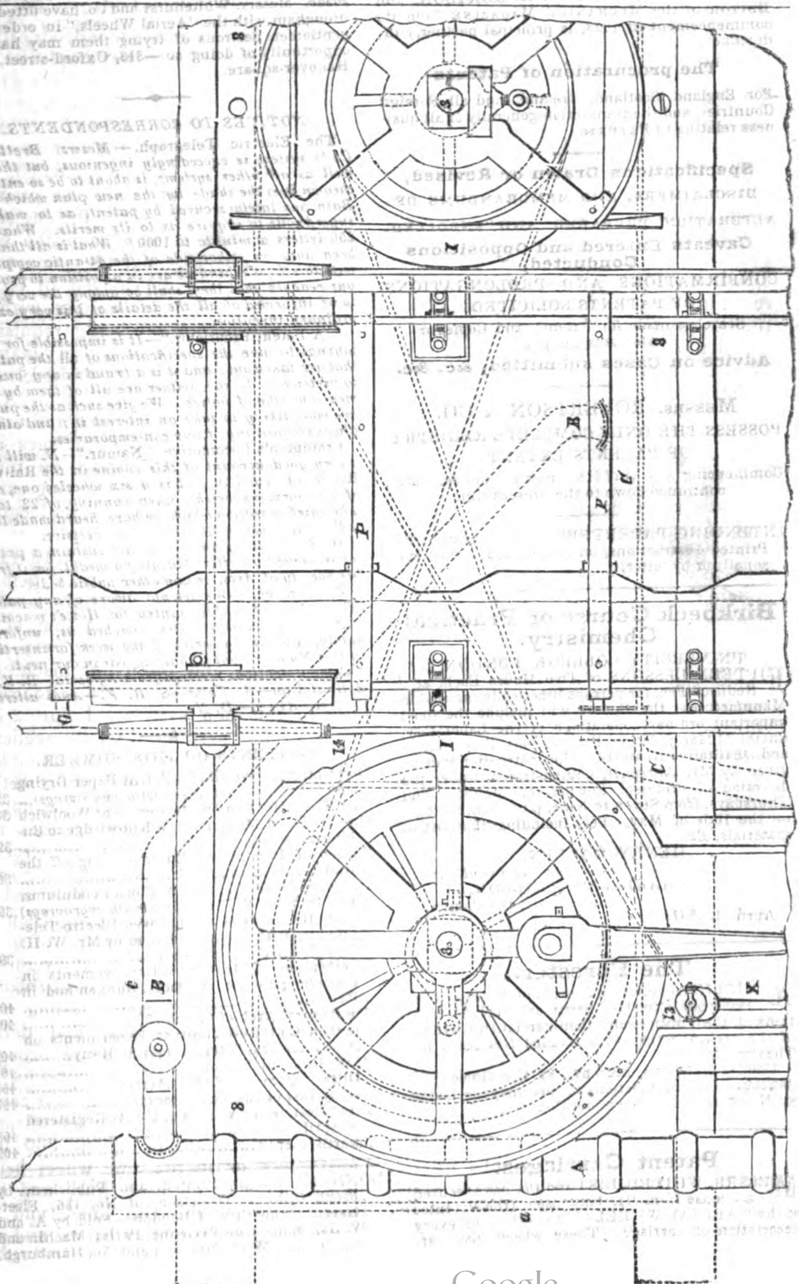
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1238.] SATURDAY, MAY 1. [Price 3*d.*

Edited by J. C. Robertson, 166, Fleet-street.



CUNNINGHAM AND CARTER'S ATMOSPHERIC RAILWAY.

Fig. 1.

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CUNNINGHAM AND CARTER'S ATMOSPHERIC RAILWAY.

[Patent dated 1st October, 1846; Specification enrolled 1st April, 1847.]

The atmospheric railway sytem is at present under a cloud. The signal failure of the Croydon, after the boastful confidence with which complete success was anticipated, now more than two years ago, has caused the public mind to fall back with a prodigious increase of reliance on the (supposed) superior virtues of the steam locomotive system. A new plan, invented by Messrs. Clarke and Varley, is in the course of being tried at the Blackwall Railway; but the improvement involved in that extends no farther than to the form of the tube—the substitution of a resilient for a rigid tube. We have now to lay before our readers a plan which reaches to the whole system —which takes atmospheric exhaustion for its ruling principle—but works it out in a way entirely different from any hitherto proposed. It possesses, as the reader will immediately perceive, a great deal of ingenuity; and is distinguished by a degree of practical and workmanlike skill to which the atmospheric railway system has been hitherto too much a stranger.

The patentees state, that the improvements, constituting their invention, have special reference to that class of railways known by the name of "atmospheric;" in which the moving power is obtained by means of the exhaustion of air from tubes or other vessels, or its compression therein; and that the nature of the said improvements consists in constructing the said railways, and the carriages to be run upon them, and the machinery connected with the same, respectively in such a manner as to be productive of the following among other advantages: *First*, that the propelling wheels shall always run above and free of the rails on which the propelled carriages run, so that without making any alteration in the rails, as at present constructed, trains of carriages shall encounter neither obstruction nor stoppage at crossings and sidings. *Second*, That the number of revolutions of the propelling wheels, and the degree of adhesion of the same, may both, or either of them, be increased or diminished at pleasure (within certain defined limits), independently of the primary motive power employed; so that an engine, or engines, of any given power may be capable of a much greater range of action than at present. *Third*, That the starting of the trains, one after another, may be so regulated, independently of the drivers or guards, that it shall be impossible for one train to overtake and come in collision with another. *Fourth*, That the same train of carriages may be moved in either direction on a line of railway without any change of position being requisite; whereby a single line of railway may be made to serve in cases of limited traffic the purposes of a double line. And, *fifth*, that the cost of working and maintaining the said railway carriages and appended machinery, shall be much lower than that of any carrying establishment on the ordinary steam locomotive system.

Figure 1^a and fig. 1^b represent a transverse sectional elevation (fig. 1^b being a continuation towards the right-hand of fig. 1^a) of one section, or division, of an atmospheric double line of railway, and the carrying and propelling machinery connected therewith, constructed according to this new system. Figure 2 is a plan of the part fig. 1^a (the sectional elevation, fig. 1^a, being on the line *a b* of fig. 2); and fig. 3, is a longitudinal section of the line *c d* of fig. 1. The passenger, goods, and other traffic-carriages run upon lines of rails, A^a B^b, constructed and laid down as usual (A^a being supposed to represent the down line, and B the up line); but their propulsion is effected through the medium of other rails, O, O, called "traction rails," which are of a peculiar construction, are attached to and carried along with the carriages themselves, and derive their motive force from being brought into contact with the peripheries of a succession of revolving horizontal wheels, I, I, I, and placed in sets of three each, at distances of about 300 feet apart, less or more; one wheel being placed outside of each line, and the third between the two lines, and all three being connected by bands, and put

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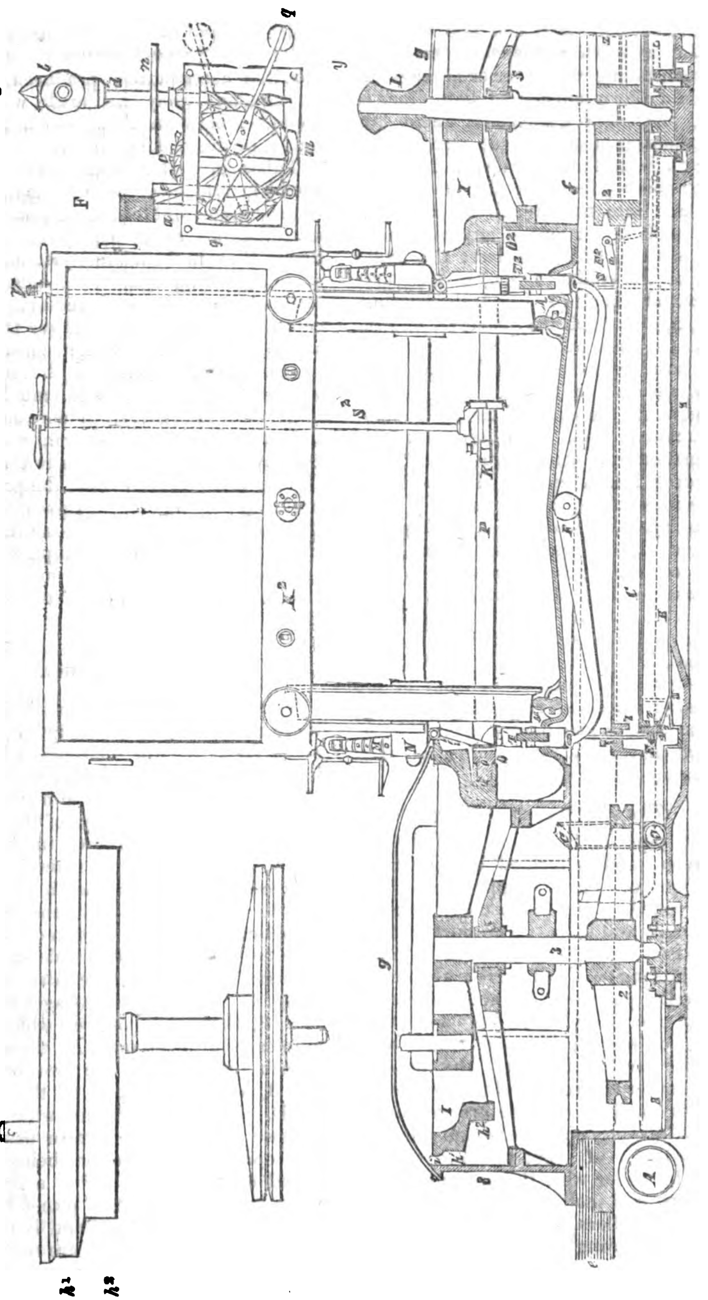
Fig. 7.

Fig. 2e.

Fig. 4.



simultaneously in motion by horizontal air-engines (D, D, two to each set of wheels) suitably stationed and communicating with an atmospheric main, A, common to the whole series of engines, and laid down outside of both lines of rails. At every distance of about 300 feet there is a trench cut transversely beneath both lines of rails, and extending to about 4 feet beyond them on each side, and into this trench an iron case, 8, 8, made in sections of any convenient size, is fitted, which encloses the under ends of the shafts (3, 3, 3) of the three horizontal wheels (I, I, I,), the bearings (5, 5, 5,) in which they revolve, and the bands (14) and pulleys (2, 2,) by which they are connected together and put simultaneously in motion; and thereby protects all the parts of the machinery, so enclosed, from being injured by wet or dust, or from being deranged through improper interference. The case being made in sections, admits not only of its being laid down with great facility, but of access being readily had to any portions of the enclosed machinery, for purposes of inspection or repair. The wheels (I, I, I) are themselves all above the ground line (*ef*, fig. 2), and the air-engines, D, D, are mounted on platforms immediately behind, or in front of the two outer wheels of each set.

The details peculiar to each part or branch of these arrangements are next separately described.

The Atmospheric Main.

The pipe A is about 10 inches in diameter, and is formed of corrugated cylinders of sheet copper, or other thin rolled metal connected together by flanges and bolts. The corrugations are raised upon the cylinders in manner following:—Two rollers are mounted in parallel positions in a suitable framework, one of which, has one, two, three, or more projecting rings of a semicircular section, and the other a like number of grooves of a corresponding section, the rings and grooves being situated exactly opposite to one another. The cylinder of sheet metal is slipped over the roller with the projecting ring or rings, and motion being then given to the two rollers, and the rollers at the same time brought together by means of set screws in the way ordinarily adopted in metal rolling-mills, the parts of the tubes which come between the projecting and the grooved parts of the rollers are pressed outwards, and the required corrugations produced. The corrugations may be made with any distances between them which may be found, or deemed expedient.

Tubes of rolled sheet metal, which would in a plain or perfectly cylindrical state be quite unfit for the purposes of this invention, are rendered, by the corrugation of them in the manner just described, so much stronger, as to be equal to the resistance of all such pressures as are commonly required in railway traction; and such tubes are besides, in consequence of the superior density of the metal of which they are composed, much more impervious and therefore more air-tight, than the tubes of cast-iron ordinarily employed in atmospheric railways. But although for these reasons the patentees prefer employing tubes of this description, they do not restrict themselves to the use of them, but claim a right to employ tubes of any sort which will answer more or less effectually the purposes of their invention.

The Air-Engines.

These engines differ in nothing from those of the ordinary description, except in so far as regards the modes of working them. Those of each pair communicate with the atmospheric main A, and with one another by means of the branch pipes, B and C, as shown in the plan, fig. 2; so that when the main is opened or closed to one engine, it is equally opened or closed to both, and both are simultaneously set in motion or stopped. E, E are the two starting slide valves. A sectional view of both these valves is shown in fig. 1. It has three passages or ways, 1, 2, 3, the centre one of which communicates with the main A, through the branch pipe B; and the two others, 1 and 3, are always open to the engines D, D. The slide 4 is just wide enough to close or cover the centre passage 2, and opens the same on being either raised or depressed. E^2 is a reversing valve apparatus which is placed between the two starting valves, and is common to both engines. F, F are oscillating levers; each of which is attached by

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Fig. 3^a.

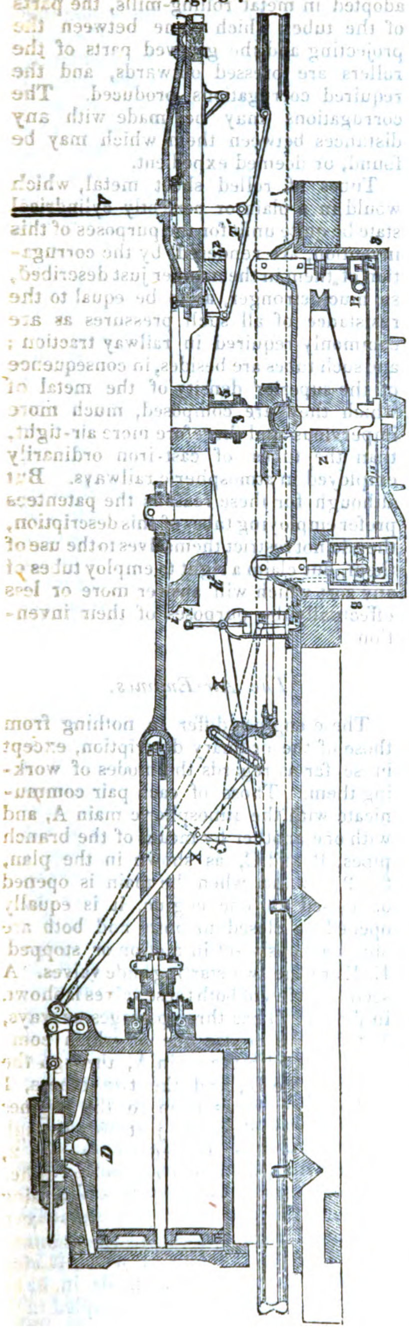
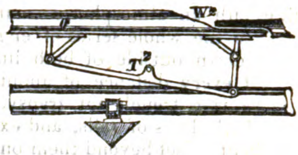


Fig. 3^b.



one arm to the spindle of one of the starting valves E, and by the other arm to a reversing rod S, which acts through the medium of a bell crank on the reversing valve E^2. The levers F, F again are actuated by two inclined planes, T^1, T^2, which are hinged to the under part of the traction rail-frame O (afterwards described); one on the near side of the carriage at the fore end, and the other on the off side at the hinder end, as shown in figure 3^b. Each of these planes may be raised or lowered by means of a vertical rod U, which is screwed at top, and worked by a screw nut and handle, placed within the reach of the driver, or guard. (To enable this inclined plane at the same time to yield upwards to any obstruction it may accidentally encounter, there is a spiral spring coiled round the rod U, between the screwed part at top and the eye-hole guide *v*.) Each inclined plane, however, is provided with the rod (U) only when the carriage to which it is attached is required to run in both directions on a line; for when the carriage has to run in one direction only, it is only necessary to attach such rod to the fore-end inclined plane T^2. Supposing now the carriage to be advancing on the down line A^a, the fore-end inclined plane first comes into contact with a friction wheel attached to the top of the starting slide valve E, and, depressing that valve, thereby opens the communication between the main A, and the two engines (D,D), as shown in fig. 1^b. The hinder end inclined plane T^2, next comes into contact with a friction wheel attached to the top of the reversing rod S, and by pressing down that rod raises up (through the medium of the connecting lever F) the starting slide E, and thereby shuts off the communication between the engines

and the main A. The arrangements for reversing the action of the engines are separately represented in fig. 5. From this figure, and the plan fig. 2, it will be seen that the reversing slide apparatus (E^2) besides communicating by a pipe 11, with the main A, through the branch pipe B, has a communication by a pipe 12, with two small cylinders 13, 13, the pistons of which are connected to the slide rods X, X of the air-engines D, D. When the rod S, at the reversing end of the lever F, is pressed down, a tappet *b*, which projects from it, comes in contact with, and presses down the upper arm of the bell crank *a*, attached to the side of the sunken case 8, and thereby throws out the under arm *c*, which causes the slide, with which it is connected, to move over the passage 4, and open the passage 5, which leads to the pipe 11, whereby a communication being opened both with the main cylinder A, and the small cylinders 13, 13, the pistons of the latter fall down and produce a corresponding action on the engine slide rods X, X, in connection with them, which causes the slides of the engines D, D to be reversed.

On the next descent of the starting end of the lever F, the upper arm of the bell crank *a* returns to its original position (assisted by a balance weight *d*), and the under arm draws back the slide of the reversing apparatus over the passage 5, and opens the passage 4 to the atmosphere, thereby destroying the vacuum in the small cylinder 13, 13, and allowing the engine slide rods X, X, to return to their original positions, as shown in fig. 3. As the bell cranks on the two ends of the slide of the reversing apparatus act necessarily in opposite directions, the arrangements, which have been just described, can of course apply only to the case of the apparatus being acted upon from one side only—say, that of the down line. To enable, therefore, the apparatus to be equally acted upon from the opposite side, or up line, the rod S on that side has the tappet *b* so placed that it shall act upwards against the upper arm of the bell crank *a*, and by the raising thereof produce the same effect as by the depression of it in the other case.

To prevent collisions, from the starting of one carriage or train too soon after another, a time safety apparatus, of the description separately represented in fig. 7, is provided. This apparatus is mounted in a square iron frame *g*, *g*. F represents the starting end of the oscillating lever F, which commands the starting and reversing slides; *c* is a wheel, with angle teeth on its circumference, and a circle of ratchet teeth at the side; *b* a weighted lever, centred on the axle of the wheel, which is joined at its short end to a vertical piece *a*, and carries also at the same end a small roller *f*: *e* is an upright locking piece, which turns on a pin at the bottom of the frame, and is free to move in the space between the axle of the wheel *c*, and the vertical piece *a*; *m* is a spring which acts against the lower end of the locking-piece *e*; *d* is a vertical shaft, on the under end of which there is an endless screw, which is in gearing with the angle teeth of the wheel *c*, and on the upper end a signal lamp *l*; *n* is a fly wheel attached about midway to the shaft *d*. The action of the apparatus is as follows: Supposing a train to have been started by depressing the starting end of the oscillating lever F, and thereby opening the communication of the engines with the main A, the descent of that end of the lever presses down the short end of the lever *b*, and raises the long end, changing both into positions such as indicated by the dotted lines; and in this position the lever *b* is left temporarily fixed by means of a spring catch acting on the inside of it (not seen in the engraving), which takes into the vertical teeth on the side of the wheel *c*. The upright locking piece *e* now falls forward by the pressure of the spring *m* upon it under the lever F, and prevents that lever from again descending, and thereby from again opening the starting valves E. And so matters would remain, but that the gravitating force of the weight *y*, gradually depresses the long arm of the lever, and produces the corresponding ascent of the small arm of the lever, which causes the roller *f*, at the end of that arm, to press back the locking piece *e* from under the starting end of the lever F into the position which it first occupied. Now as the long arm of the lever describes in its descent the arc *p*, *q*, it necessarily turns round to a corresponding extent the wheel *c*, to the axis of which it is attached; this wheel *c* is made in its turn to determine the time occupied in

the descent of the weight *y*, and in the consequent restoration of the different parts of the apparatus to their original positions, so as to leave the way clear for the next following train. For, according to the number and pitch of the angle teeth on the circumference of this wheel will be the retarding force of the wheel. And until the weight has descended, no other train can follow that which first put the apparatus in motion. The apparatus may be either placed within the smaller case 8, as shown in fig. 2, with the exception of the upper part of the shaft *d*, and lantern *l*, and employed in that case to lock the ascending levers F, F; or it may be placed on the same platform as the air-engines, and employed to act as a signal only; the lamp (*l*) in the latter case being left free to revolve during all the time the weight *y* is descending.

Fig. 2^b.

Fig 6.

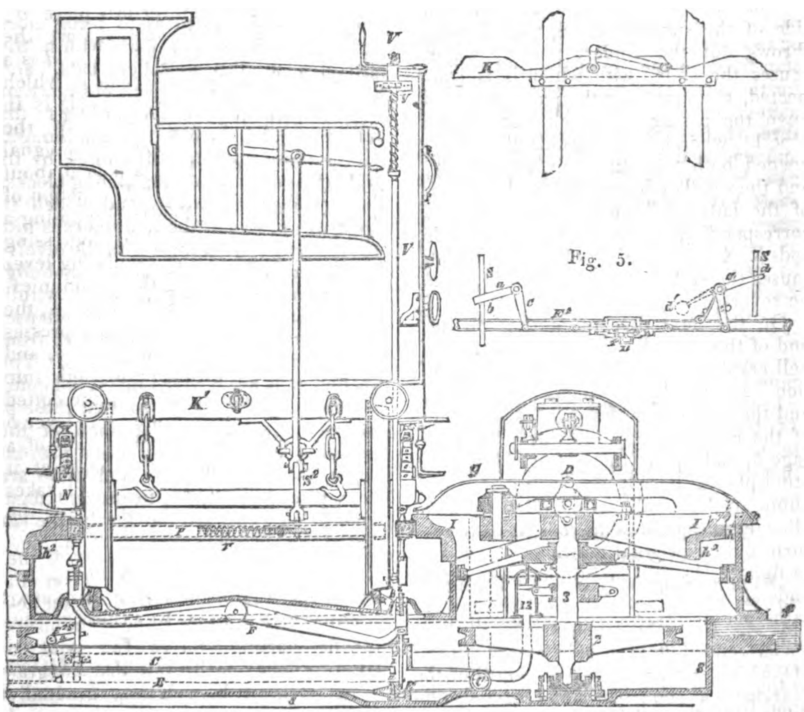


Fig. 5.

The exhaustion of the main A, or compression of air into it, may be effected either by steam power, as is now the ordinary practice on atmospheric railways, or by water power, where that is readily attainable.

The Horizontal Propelling Wheels.

The vertical shafts (3, 3, 3,) on the top of which the horizontal wheels are fixed, rise to the height of about 21 inches above the level of the rails A^a A^b. A view of one of these wheels detached from the rest of the machinery is given in fig. 4. Each wheel has two peripheries h^1 h^2 of different diameters (and may have more if thought expedient), the upper periphery h^1 being the larger of the two, which admits of the wheels being adapted either to a fast or slow motion. In fig. 2 the traction rail of the carriage K^1 of the down line, is

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supposed to be in contact with the larger periphery, and that of the carriage K^2 on the up line to be in contact with the smaller. The centre wheel is, at its greatest diameter of width, just sufficient to fit into the space between the two lines of rails $A^a A^b$. The two outside wheels are larger than the centre wheel, but both of one diameter; and they are so fixed that their flanges *i*, *i* shall come on a line with the outside of the outermost of the rails $A^a A^b$. The flanges of all the wheels project a little over the traction rail O (afterwards particularly described), and serve thus to prevent the carriages of a train from either rising off, or swerving from the rails. L is a capstan fixed on the top of the centre shaft, for the purpose of hauling carriages from sidings or otherwise. On each of the three shafts there is, near to the bottom, and enclosed within the under-ground case 8, a pulley 2 (that on the centre shaft having two grooves on its periphery, and the two others single grooves); and all the three pulleys are connected by bands 14, 14, as shown in fig. 1. Each of the outer wheels I, I, is connected at top (that is on the outside of the under case 8) by means of a crank-rod and pin to the air-engine D stationed near it. And as all the three wheels are connected by the bands 14, 14, it follows that on motion being given to the outside wheels, or either of them, that motion is simultaneously communicated to all the three wheels.

The Traction Rails and their Accessories.

Each carriage body (see K^1 K^2 fig. 1^a fig. 1^b) is supported as usual on springs M, M. From the axle boxes N, N, there is suspended on each side a traction rail O, which extends the whole length of the carriage, as shown in fig. 1, and also on the right-hand extension of the longitudinal section, fig. 3. This traction rail consists of a square-like piece of wood O^1, enclosed on three of its sides in a casing of iron, O^2, the side left open or uncased, projecting, as shown a little way beyond the iron casing. Any of the sides of this rail may be that which is brought into contact with the periphery of the adjoining propelling wheel, according to the degree of adhesion desired. In the carriage K^1, the wooden sides of the rails are represented as being in contact with the propelling wheels; and in the carriage K^2 one of the iron sides. Each pair of traction rails is connected transversely by several stretcher bars P, P, and each stretcher bar contains within the body of it a spiral spring *v*, which has attached to the end of it a sliding block *n*, which abuts against a wedge bar K, of the peculiar shape shown in fig. 1, which is passed longitudinally through apertures in the stretcher bars. S^2 is a jointed lever connected to the wedge bar K, and placed within the reach of the driver, or guard of the train, by means of which he can move the wedge bar to and fro at pleasure, as shown separately at fig. 6, so as to bring more or less of the broad part within the apertures in the stretcher bars, and thereby protrude or stretch out more or less the traction rails. According to the extent to which the broad part is brought within those apertures, it causes, by its pressure against the spring sliding blocks, the stretcher bars to expand, which in their turn press out the traction rails into more or less close contact with the revolving horizontal wheels next adjoining. But when the narrow part only is within the apertures, the stretcher bars collapse, and the traction rails are withdrawn from contact with the propelling wheels. The traction rails are bevilled off at the ends, as shown at W^2, fig. 3, so that those of one carriage may overlap those of the adjoining carriages, and thus prevent any chance of collision; and there are stops placed at W, W, to prevent them from being expanded too far by the action of the stretcher bars.

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

No. 4.*—BIQUADRATIC EQUATIONS.

In solving a biquadratic, deprived of its second term, by the method of DESCARTES, we decompose the given equation into two quadratic factors. Let these factors be represented by X_1 and X_2 respectively, and let F_1 and F_2 be determined from the two following equations,

$$F_1 + F_2 = X^1,$$
$$F_1 - F_2 = X_2,$$

then the given biquadratic will be equivalent to

$$F_1^2 - F_2^2 = 0,$$

* No. 3 will be found *ante*, page 177.

the form to which it is reduced when we solve it by the method of FERRARI. The two solutions are closely connected—so closely, that the former method involves the existence of the type of solution which we have seen* to belong to the latter one. These solutions are both obtained by what I have termed the *subsidiary method* †. The solution of SIMPSON, a modification of that of FERRARI,‡ adapts the latter to the case of a perfect biquadratic. To this case the method of DESCARTES may also be extended, as will be seen on referring to an article by me at pages 104—106 of vol. iii. of the *Cambridge Mathematical Journal*. The types of solution of these latter methods it is unnecessary to discuss.

So long as we employ the subsidiary methods only, it is not requisite to *transform* the given equation. But there are methods of solving a biquadratic in which a transformation is an essential ingredient. When, however, the transformation is linear—that is to say, when we substitute for x, the root of the given equation, the algebraic sum of a number of undetermined quantities—the type of solution may be exhibited in nearly the same form as before. Thus, on referring to a solution§ of a biquadratic at pages 254—256 of vol. i. of the *Cambridge Mathematical Journal*, we see that the type of solution, as given by the equation at line 6 of page 256, may be represented thus:

$$F''(z+\tfrac{1}{2}P)=F''(A),$$

for z substitute its value in terms of x, and multiply both sides of the equation by x^2; then it becomes

$$F''(x^2+\tfrac{1}{2}Px+\frac{R}{P})=F''(Ax);$$

but, as we have heretofore supposed the original equation to be in x, whereas in the present case the given equation is one in y, we must, to make the above notation conformable to that hitherto used in these notes, write $x-v$ for x in the last equation.‖ The type of solution of a biquadratic in x deprived of its second term will, in this method of solution, be of the form

$$F''\{(x-v)^2+\alpha(x-v)+\beta\}=F''\{A(x-v)\},$$

whence that for a perfect biquadratic may easily be deduced.

As might have been expected, this last type of solution differs in no essential respect from that which we have before* had presented to us. The solution is obtained by the *pseudo-indeterminate* method.† A biquadratic, however, admits of a solution by the *pure indeterminate* method.‡

Such a solution of a biquadratic as that last alluded to will be found at page 97 (No. 551) of vol. ii. of the work mentioned below.§ There, after substituting $y+z$ for x in a biquadratic deprived of its second term, the new equation is broken up into two others, and a resulting equation (in z) of the sixth degree is obtained. This last equation is, however, in the succeeding page (98) of that work, by an easy simplification, made to coincide with what, on referring to the books, we shall see to be the reducing equation in DESCARTES' solution. I shall, therefore, for the present, at least, dismiss this method.

I have already‖ adverted to a seeming—and it is only a seeming—want of generality in the theory of biquadratic equations. We have no solution of them by means of irreducible biquadratic surds; nor, in fact, is such a solution possible.* Still, one or two remarks upon the point may not be undesirable.

The objects which may be supposed, for the most part, to actuate those who would endeavour to give a greater apparent completeness to this branch of science will, perhaps, be inferred from the following passage, which is translated from pages 15 and 16 of a work mentioned in the accompanying note:†

"..here, it will be sufficient for us to remark that the equation of the fourth degree is by no means yet resolved under the true primitive form of its roots,...:

* *Ante*, pages 122—3.
† *Ante*, page 124.
‡ *Penny Cyclopædia*, vol. xxiv., p. 340, col. 1, (Article "Theory of Equations.")
§ This solution is, I believe, due to Mr. Greatheed, and is, if I recollect aright, quoted by Dr. Peacock in vol. ii. of the last edition of his *Algebra*.—J. C.
‖ As to this see *Cambridge Mathematical Journal*, vol. i., p. 255, line 9 from the bottom.—J. C.

* *Ante*, page 123.
† On this see *ante*, page 179.
‡ Ibid.
§ A complete Course of Pure Mathematics. By L. B. Francœur. Translated from the French by R. Blakelock, M.A., &c., Camb., 1830.—J. C.
‖ *Ante*, page 128.
* Ibid.
† Résolution Générale des Equations de tous degrés. Par Hoëné Wronski. Paris. 1812.—J. C.

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under this primitive form, the resolution of the equation of the fourth degree began to present the same difficulties as the resolution of the equations of the higher degrees presents, difficulties which it has not been possible to surmount even to this day; and it is only by two accessory circumstances, belonging exclusively to the equation of the fourth degree, that these general difficulties have been avoided, and that it has been possible to give, of the equation of this degree, two particular solutions,* purely accidental."

It would have been well had all the views of the author of the remarks just quoted been characterized by the same soberness, and been as little open to objection as that passage. But, having given the quotation, I feel bound to add that one best qualified to judge of the merits of the work has decided against the soundness of the views expressed in it. On referring to pages 314, 315, of the *Report on, &c., certain Branches of Analysis*,† it will be seen that the high authority to which I allude, (Mr., now) Dr. Peacock, Dean of Ely, has, after a most extensive survey of the whole question, pronounced an opinion which, though given indirectly, is decisive, and has doubtless set the matter at rest in this country. The simple and moderate statement of Dr. Peacock, at p. 315, conveys in reality a severer censure than the set reply of GERGONNE, at pages 206—209 of tome iii. of the *Annales de Mathematiques*.

In commenting on the work from which the above passage is translated it was pointed out by GERGONNE at page 54 of tome iii. of the *Annales* that a form of the roots (of a biquadratic) involving biquadratic surds had been considered by BEZOUT in the *Mémoires de l'Académie* for 1762 and 1765 and in his *Cours;* and also by VANDERMONDE in the same *Mémoires* for 1771.

The paper in the *Mémoires* for 1762, above alluded to, is restricted to cases in which the roots have certain particular forms there discussed. But on referring to pages 538, *et seq.* of those *Mémoires* for 1765, to page 151, *et seq.* of the title *Algèbre* of the *Cours* just mentioned (Reynaud's edition, of 1829), and (first, to page 376, Art. vii., to page 380, Art. xii., and then) to pages 387 and 388, Art. xxii. of the *Mémoires* for 1771, it will be seen that BEZOUT and VANDERMONDE, although they employed the unreal (or "primitive") fourth roots of unity in their researches, were yet compelled to make (implicit) use of an "accidental" property of those roots—to take advantage of the fact that there subsists among the unreal fourth roots of unity (which we may represent by powers of (a) one of them) not only the relation

$$1+a+a^2+a^3=0,$$

but also the relation*

$$1+a^2=0.$$

The problem, to the consideration of which we are now about to proceed, involves a transformation of the given equation very different to that which has hitherto been brought under our notice. The linear transformation, as I have above observed, is effected by simply *substituting* for x the sum of other unknown quantities, of which let y be one.† Then, however numerous be the other quantities, since they enter in the same manner into the coefficients of the equation in y, they afford us no more aid in modifying that equation, than if we had simply substituted $y+z$ (*i. e.* the sum of two quantities only) for x in the given equation. How then are we to overcome this difficulty and to introduce into the coefficients of the equation in y a number of undetermined quantities sufficient to enable us to make the requisite modification of the transformed equation? The reply is,—By making y equal to

$$P+Qx+Rx^2+\&c.,$$

and then eliminating x between this equation and the given one. This elimination is not performed, as in the case of linear transformation, by substitution; nor by solving either of the equations between which the elimination is to be performed, nor in any similar manner; but by means of considerations derived from the Theory of SYMMETRIC FUNCTIONS. By such means we may in general introduce into the coefficients of the equation in y as many disposable quantities as may be required. I say

* The solutions referred to are, as we are informed in the note (*) of page 16, those of BOMBELLI, or DESCARTES, and of EULER.—J. C.

† See the *Report of the Third Meeting of the British Association for the Advancement of Science* (London, 1834).—J. C.

* See some excellent remarks of GERGONNE on this point, at pages 137—139 of the *Annales*.—J C.

† Is the difference between the linear, and other, transformations sufficient to justify us in appropriating a term to denote the first-mentioned transformation—for instance, may we term a linear transformation a *change* of the given one?—J. C.

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in general, because, x being the root of the general equation of the n*th* degree, *a symmetric function of any rational function of* x *is—whatever be the number of quantities free from* x *involved in that rational function—substantially, a homogeneous function of, at most,* n *free quantities*.*

This proposition exercises a most important influence over the results of many of our inquiries respecting equations. Results of a *primâ facie* validity, when tested by it, are clearly seen to be illusory; one or two instances will be given in this paper. But, if the results are illusory is the subject worth pursuing? Yes; for various reasons: And, first, the limits of each class of illusory results are the frontiers from which extend indefinitely a number of valid ones. And, further, when in circumstances apparently isolated we can trace the operation of a common principle, we attain to that which is most excellent in knowledge, and without which all knowledge would be but a lifeless and unconnected accumulation of facts. Still higher is the gratification when, in any particular case, we are able to say *why* the principle operates. And if in the Theory of Equations we find an eminent example of a study which, even among mathematical subjects, is remarkable for the general principles which it involves, that alone would perhaps justify me in strongly recommending it to those who read for other than the most obvious practical purposes. Not that, even in a practical point of view, it can be objected with certainty that *any* branch of mathematics is, when taken in its whole range, devoid of utility. Such objections have their origin in ignorance or presumption, and ought not to be heard in this inquiring and progressive age. If listened to, they would be found ultimately to affect not only Practice but Theory. As well recede at once from the ALGEBRA OF PEACOCK and return again to a spurious Algebra, the illicit offspring of an (in principle at least) illogical generalization of results which, in their origin, do not admit of the extended meanings usually attributed to them, and which, in order to their true comprehension, must be envisaged by means of the Modern Algebra—when we see at once their vitality and their true import.

To return to the subject of biquadratic equations. Let it be required to reduce a biquadratic in x to another in y, which shall have its second, third, and fourth terms equal to zero. Besides the discussion of this problem, which will be found in the *Nouveaux Mémoires, &c.*, (of Berlin) for 1771,* there are modern attempts at its solution, on which alone I propose to dwell in the present article.

This reduction depends upon our being able to satisfy simultaneously a linear, a quadratic, and a cubic equation. In fact, the equation in y being

$$y^4 + A'y^3 + B'y^2 + C'y + D' = 0,$$

we must have

$$A' = 0,\ B' = 0,\ C' = 0.$$

In part the second† of his *Mathematical Researches*, Mr. Jerrard has considered the corresponding transformation for equations in general. To avoid elevation of degree arising from elimination, *he makes one of the disposable quantities* (Q) *disappear from* $B' = 0$; and so satisfies that condition independently of Q. Mr. Jerrard, in fact,‡ by a modification of the original equation in x causes Q to disappear both from $A' = 0$ and $B' = 0$. Consequently Q may in general be determined so as to satisfy the remaining condition $C' = 0$. The particular case in which the given equation is a biquadratic is adverted to at page 69, *et seq.* of the work last alluded to. Mr. Jerrard there shows that when y is that particular function of x, which he has at page 51§ of his work assumed it to be, the transformation fails. He then proceeds as follows:‖—

"What makes this result the more remarkable is that the ordinary method (that in which no separation is effected among the quantities P, Q, R, S,) succeeds with this particular value of m,* and no other. There is however an unlimited number of functions," .... "which are proper for reducing the general equation of the fourth degree to

* See page 301, [4] of a paper by Sir W. R. Hamilton in the *Report of the Sixth Meeting of the British Association.* (London, 1837.)—J. C.

* In a paper by LAGRANGE.—J. C.

† The reader is referred to p. 43, of that part, Nos. xxi., *et seq.*—J. C.

‡ See *Math. Res.* Part II., p.p 51 and 52.

§ Line 2; y is the same as ϕx—J.C. ‖ *Math. Res.* p. 71.

* The degree of the given equation....J. C.

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the binomial form $y^4 + D' = 0$ according to the method in XXII."

At a subsequent part of his *Researches* (pp. 80—87,) Mr. Jerrard shows how the general equation of the *mth* degree may be deprived of its second, third, and fourth terms. This differs from the investigation above alluded to, in as much as in the former case the given equation is (*Mathematical Researches, p.*51, *line* 4) supposed to want its second and third terms.

It follows from a proposition which I have above alluded to, that *the co-efficients of the transformed biquadratic are, in substance at least, homogeneous functions of at most four disposable quantities.* Sir W. R. Hamilton has hence shown* that Mr. Jerrard's proposed method of annihilating the three middle terms of a biquadratic becomes illusory.

The method which I have proposed for effecting the same transformation, consists in *reducing the quadratic which arises after taking into consideration the equation $A' = 0$, to the sum of two Algebraic squares, involving quantities perfectly undetermined.*† This enables us to depress the quadratic to a linear equation, and so avoid elevation of degree from elimination.

Although valid when applied to the corresponding transformation for equations of the higher degrees, the last method does not enable us to reduce a biquadratic to the proposed binomial form, as I have elsewhere‡ shown. Its failure so to do originates in the proposition which invalidates Mr. Jerrard's result. Those who think it worth while to refer to my discussion of the general problem, will find it at pp. 132, 133, 395 of vol. xxviii of the present series of the *Philosophical Magazine*, and at the place cited below (in note †).

In a former volume of this work § I alluded to a modification of inferences which I had drawn at pp. 300, 301, of vol. I. of the *Mathematician*. The equation (63) h of the latter page, if considered homogeneous, must, in order that it may be used with effect, be a homogeneous function of at least three undetermined quantities. And since two of these undetermined quantities vanish from (62) h, (as, in effect they must do,) the latter equation, also supposed homogeneous, necessarily involves two undetermined quantities, *i. e.*, *one* additional quantity. This makes in all four undetermined quantities. Add to this that p_6 and q_6 vanish altogether from $B = 0$ *, and we see that the expression for y ought to consist of *five* distinct terms; and, consequently, that this mode of transformation cannot be applied in the present cases to equations of a degree less than the fifth.

The method proposed by Mr. Jerrard† for satisfying simultaneously equations of the first, second, and nth degrees, between the same unknown quantities, will, if there be only a quadratic and an "n-ic" equation to satisfy, be applicable with effect when the number of unknown quantities in the quadratic is not less than *five*. Now, the annihilation of the second, third, and fourth terms of an equation may be made to depend upon the solution of a quadratic and a cubic equation between the same unknown quantities.‡ If the question were to be treated in this way, the method of Mr. Jerrard would require us to assume for y an expression, in terms of x, consisting of *five* terms, while mine would require an expression containing *four* only.§ If we were, however, to solve the linear equation separately, and if Mr. Jerrard were to use latter equation to eliminate one of the this unknowns in the ordinary manner, his method would require an assumption for y consisting of *six*‖ terms, while mine would require *five*. In the investigation at pp. 78 *et seq.* of his *Researches* he employs *seven*.

When applied to the reduction of a biquadratic to the binomial form $y + D' = 0$, we have seen two independent methods conduct to illusory results. This

* *Sixth Report of the British Association*, p.p. 298—306, arts. [2] [3] and [4].—J. C.

† *Mathematician*. vol. i., pages 114, 115.

‡ *Philosophical Magazine*, s. iii., vol. xxviii., page 395.—J. C.

§ See *Mechanics' Magazine*, vol. xliv., p. 404.

* This is a "critical" equation; see *Phil. Mag.*, s. iii., vol. xxviii., pages 191, 395.—J. C.

† *Math. Res.*, p. 80, *et seq.*—J. C.

‡ See *Mathematician*, vol. i., p.p. 113, 115.—J. C.

§ *Ibid.*, p. 115; *Philosophical Magazine*, s. iii., vol. xxviii., page 132. The reduction involved in this question assists us, somewhat materially, in the consideration of *Surfaces*. I may perhaps refer the reader to my *Chapters on Analytical Geometry*, published in the last and present volumes of this work and in which I shall continue as opportunity offers.—J. C.

‖ Is this what is alluded to by Mr. Jerrard in the note at page 93 of his *Researches?*—J. C.

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can scarcely be the effect of chance. *Why* then should these methods fail when, as is observed by Mr. Jerrard in a passage quoted in another part of this paper, another method succeeds? The explanation is, I think, as follows:—

If the equation in y can be reduced to the above form, we may obtain an expression for x in terms of $\sqrt[4]{D'}$ and other quantities*;—an expression, consequently, involving biquadratic surds. Now, if the course of our processes be such that these cannot be other than *irreducible biquadratic surds;* then, since x can never be expressed in terms of surds of this description, the processes must inevitably fail† to conduct us to an available result. But if, on the other hand, in the course of our investigations, we have made some assumption inconsistent with the irreducibility of the surds, the processes may undoubtedly be valid. In another of these Notes I hope to show pretty clearly that the methods of Mr. Jerrard and myself,—depending upon no assumption, but attacking the problem directly and seeking to beat down the obstacle—carry in themselves the seeds of failure; while the ordinary method, more flexible in its character, takes advantage of a break, and glides through the barrier.

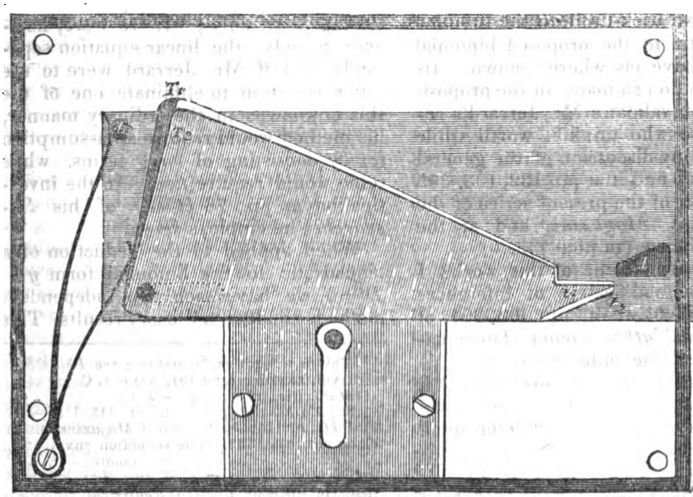
I am, Sir, yours, &c.,

JAMES COCKLE.

2, Church-yard-court, Temple, April 27, 1847.

IMPROVED SPRING LOCK.

SIR,—Spring locks (whether for doors or boxes) as they are usually made, are very insecure. The difficulty of opening them can only be made to depend upon fixed wards; and generally a key or pick of the most simple kind will open them. They cannot be secured by tumblers, because the very object of tumblers is to prevent the bolt from being pushed back without the tumblers being previously raised; whereas it is necessary that the bolt should be capable of being pushed back by the shutting of the door, or of being drawn back by a handle. There are indeed locks made by Chubb, for the purpose of obviating this objection, by contrivances which I need not describe; but such locks are necessarily very expensive: and it seems to me that the opening of a spring lock may be made to depend upon raising tumblers to a proper height, much more simply and cheaply in the following manner.



Let L l be the bolt of a spring lock made in the usual way, with a shoulder

* See Mr. Jerrard's *Math. Res.* p. 39, note.—J. C.

† *Ante*, page 123, left-hand column (No. 2 of these Notes).—J. C.

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or a pin at L, projecting so far as to cover the thickness of all the tumblers.

$T_1 t$, $T_2 t$, &c., any number of tumblers.

The ends T of the tumblers are so formed, that when the tumblers are raised a little by the key, they will begin to press against the shoulder, or pin L of the bolt; and when the tumblers, or any of them, are raised still further they will draw the bolt back. So that, as far as this goes, the bolt would be opened by any of the tumblers when raised enough by the key: the key not touching the bolt at all.

But there is also another pin or stop *l* fixed into the bolt in front of the rising end of the tumblers: this pin is, in fact, the same as the common stop for the tumblers of a tumbler lock. The ends of the tumblers are to be cut into the shape shown in the figure; and it will be observed, that when the lock is at rest, and the tumblers down, the stop *l* can pass just *above* the projecting ends of all the tumblers; so that when the door is being shut, or the lock opened by the handle, the bolt goes back as if there were no tumblers. But when the lock is to be opened by the key, the key has first to raise the tumblers a little before they will act upon the pin L; but as soon as *any* of the tumblers are raised at all, their projecting ends *t* will prevent the stop *l* from going back, and the bolt cannot be drawn back until *all* the tumblers have been raised enough to let the stop pass *under*, instead of above, the projection *t*: but if any tumbler is being raised too quickly, the motion cannot go on, because that tumbler will begin to press against the pin L, and try to pull back the bolt before the other tumblers are clear of the other pin *l*. So that unless the key is so formed as to raise all the tumblers above the stop exactly at the same time, it cannot begin to draw back the bolt.

It is evident that there must be at least two tumblers; and there may be as many more as you please.

The handle of this, and all other spring locks, if used as "latch locks," ought to be made to *turn*, and not to draw back as they usually do; for nothing is easier than to draw back such a handle by means of a wire through a hole made in the door.

Your obedient servant,

E. B. Denison.

Lincoln's Inn, April 23, 1847.

DECOMPOSITION OF WATER BY GALVANIC ELECTRICITY.

Sir,—Your correspondent, "A. H." propounded, some time ago, a theory of the separation of water into its gases by galvanic electricity. In hopes of eliciting further discussion of the subject, by recalling the attention of your readers to it, I shall make a few observations upon a very interesting point alluded to in his communication.

He suggests that the phenomena of "interferences" probably exist where the electrical undulations are treated in a manner similar to that for displaying them from the luminous undulations.

There appear to me to be insuperable difficulties attending our attempts to exhibit them, and "A. H." would much oblige me, and I am sure all those who admire these confirmations of the undulating theory, if he should assist in overcoming them.

1. Electricity passing through a metallic body is traversing a medium not homogeneous, hence the phases of condensation and rarefaction will recur at unequal intervals; and I should therefore suppose that the interference will take place only at one point, unless the current in the opposite direction have its phases at intervals, which are some multiple of those of the first current.

2. We are endowed with a sense (that of sight) for apprehending the presence of luminous interferences; but for electrical ones we must use mediate apparatus; and I cannot conceive, even after long consideration of the subject, how such could be applied with the required delicacy.

3. Besides these difficulties arising from transmitting material, we have a formidable one *in time*. Supposing two currents traversing a body simultaneously, but originally started at instants minutely separate, an interference may exist at one moment which will cease the very next; for, no electrical current is constant for even a small portion of time in intensity and rapidity of propagation.

To me these seem the principal obstacles in the *exhibition* of electrical interferences, their *existence* (under proper circumstances) being a natural result of undulations of any medium.

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In remarking upon a late suggestion of mine, published in your Magazine, I find "A Smoker" proposing "bis-

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cuit" porcelain as a material for pipes—I am afraid that he is mistaken in estimating its applicability. Common clay pipes are, in fact, an example of its use, but the absorbent powers of "meerschaum" involve a nice point for consideration. Meerschaum is originally impregnated with oil; it *therefore* absorbs oil, and transfers it to the furthest point from the heat applied; while porcelain would form a film of dried oil on the *first* surface and become clogged.

Your correspondent may see a large porcelain (unbaked) pipe at Kirk's, in Fleet-street; it is, however, as we might predict, not intended for absorption.

I am, Sir, yours, &c.,
JOHN M'GREGOR.

Furnival's Inn, April 22, 1847.

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

(Continued from page 397.)

Engineers have sometimes been reproached, and not without reason, with misconceiving the real source of that power which they direct and control: and a similar charge may be brought against many mathematicians. As in the one case, a spectator, ignorant of the real use of machinery, might judge from the admiration with which the engineer contemplates its beautiful arrangement and motion, that *in it* lay the whole power; so might the uninitiated listener be deceived by the admiration with which the mathematician views the symmetrical machinery of calculation, and go away with the notion that some wondrous engine was at work in all this mystic array of formulæ, which belonged more to the regions of enchantment and supernatural power, than to the domains of plain sense and every-day reasoning. There is indeed an exercise of the intellect in that perception of the adaptation and mutual dependence of seemingly unconnected parts which the practical eye of the engineer so thoroughly understands; but how far short does this stop of the whole mystery—how inferior is this partial view to that which should at the same time take in the whole chemical action by which the steam is ultimately produced—and so recognize, in the simple tendency of carbon and oxygen to unite, the source of the whole power displayed? As yet no one can attain this state of perfect comprehension, inasmuch as nothing is known of those ultimate motions in which chemical phenomena consist: and here then the mathematician has considerably the advantage. Not only may he distinctly see and trace, step by step, the deduction of formulæ pass from one equation to another—this is but a very inferior exercise, the mere comprehension of machinery;—but he is able to go to the source, and set clearly before his eyes each step from the beginning. It is true that such a course is often extremely difficult, and sometimes would be labour thrown away, it being frequently quite as satisfactory to *know that a certain result is true*, as to see *by what successive steps* it is so. But in many cases the whole interest lies in this seeing *how* a thing is true, as distinct from the mere knowledge that it *is* true. In this clear perception of "*how*" results are obtained, lies by far the chief difficulty of the student's reading. In the words of Sir John Herschel: "There are cases in the application of mechanical principles with which the mathematical student is but too familiar, where, when the data are before him, and the numerical and geometrical relations of his problems all clear to his conception—when his forces are estimated and his lines measured—nay, when even he has followed up the application of his technical processes, and fairly arrived at his conclusion—there is still something wanting in his mind—not in the evidence, for he has examined each link, and finds the chain complete—not in the principles, for those he well knows are too firmly established to be shaken; but precisely in the *mode of action*. He has followed out a train of reasoning by logical and technical rules, but the signs he has employed are not pictures of nature, or have lost their original meaning as such to his mind; he has not seen, as it were, the process of nature passing under his eye in an instant of time, and presented as a whole to his imagination. A familiar parallel, or an illustration drawn from some artificial or natural process, of which he has that direct and individual impression which gives it a reality, and associates it with a name, will, in almost every such case, supply in a moment this deficient feature, will convert all his sym-

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bols into real pictures, and infuse an animated meaning into what was before a lifeless succession of words and signs.

* * * *

The contention of mind for which they call is enormous; and it may, perhaps, be owing to their experience of *how little* can be accomplished in carrying such processes on to their conclusion by mere ordinary *clearness of head*, and how necessary it often is, to pay more attention to the purely mathematical conditions which ensure success,—the hooks and eyes of their equations and series—than to those which enchain causes with their effects, and both with the human reason; that we must attribute something of that indistinctness of view, which is often complained of as a grievance by the earnest student, and still more commonly ascribed to the native cloudiness of an atmosphere too sublime for vulgar comprehension."

In the preface by Airy to his *Treatise on Gravitation*, are the following similar remarks:

"The exercise of the mind in understanding a series of propositions, where the last conclusion is geometrically in close connexion with the first cause, is very different from that which it receives from putting in play the long train of machinery in a profound analytical process. The degrees of conviction in the two cases are very different. It is known to every one who has been engaged in the instruction of students at our universities, that the results of the differential calculus are received by many, rather with the doubts of imperfect faith than with the confidence of rational conviction. Nor is this to be wondered at; a clear understanding of many difficult steps, a distinct perception that every connexion of these steps is correct, and a general comprehension of the relations of the whole series of steps, are necessary for complete confidence. An unusual combination of talent, attainment, and labour, must be required to appreciate clearly the evidence for a result of deep analysis. I am not unwilling to avow that the simple considerations which have been forced upon me in the composition of this Treatise have, in several instances, contributed much to clear up my view of points, which before were obscure, and almost doubtful. To the greater number of students, therefore, I conceive a popular geometrical explanation is more useful than an algebraic investigation. But even to those who are able to pursue the investigations with a skilful use of the most powerful methods, I imagine that a popular explanation is not unserviceable. The insight which it gives into the relation of some mechanical causes and geometrical effects, may powerfully, yet imperceptibly, influence their understanding of many others which occur in the prosecution of an algebraical process."

One cannot help remarking here the influence of *words*. The expressions, "*profound* analytical process," "*deep* analysis," occurring in a passage whose very object is to show the insufficiency of these *alone* in a philosophical and rational point of view, is a very striking instance of our great proneness to impose on ourselves with fine words, or be imposed upon by others. The "depth," the "profundity," is obviously *not* in "the long train of machinery," but in that patient and determined effort by which the common sense of a process is grasped in spite of the misty veil thrown over it by the dark clouds of symbolism. Let us understand clearly and exactly what analysis *is* good for. It is not—to SHOW HOW, but—to *calculate* HOW MUCH. Then, if the forces, &c., of a mechanical problem be given, the analysis will not, and is not intended to, show us *how*, and *what kind* of motion will ensue—but to calculate *how much* of the effect is due to each force, and the place where, and time when, any particular effect will have been produced.

It is, no doubt, a frequent source of discouragement to the beginner, that he finds himself most bothered and perplexed by those parts of a treatise or problem, which he has been led to consider the most common-place and easy.

All that part of a book which is "plain English" he is apt to fancy *ought to be* the easiest. That difficulties should occur most plentifully in the mathematical part, is what he generally thinks most likely and natural; and when he finds that the "mere talking part," "the common-sense and plain English," is really to him the most difficult, he is very apt to accuse himself of stupidity. I refer now, more particularly, to those portions of mechanical treatises in which the principles are discussed, or rather slurred over, in the fewest words possible. Now, if the student will only recur to the history of the

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science, he will soon find cause to consider the matter in a very different light. When he sees such men as Galileo, Huygens, Wallis, Bernoulli, some of the greatest men that even mathematics can claim—when he sees such men as these struggling year after year to grasp some principle, or comprehend some theorem, which is now, thanks to them, found in the very elementary branches (such as accelerating force, impact and collision, &c.), he will no longer be ashamed of his own slowness of comprehension, and will henceforward look upon the thorough understanding of "principles" as both requiring and deserving a far greater "contention of mind" than any mere algebraical development. He must not grudge any time bestowed on such matters, for it will be amply repaid him afterwards. As Professor De Morgan says, they "are apt to be discouraged by the apparent slowness of their progress, *which they measure by the pages read*, without any other consideration."

It frequently happens, that one or two sentences thoroughly mastered will carry the reader on at one bound over some scores of pages afterwards. It takes some time to get the steam up, but when it is, you may dash onwards at the speed of a hurricane.

Next to a sound and healthy brain, the most valuable acquisitions to a student, are—pens, ink, and paper. Few know their value. It may be all very well to sit reading by the fire-side when the book goes on all smoothly and easily—but the instant any real difficulty occurs, there is no help like that of writing. Most students are in the habit of using this for the algebraical processes required; but this is but a very small part of its real value. Of all the stumbling-blocks in the student's way, by far the greatest are those cases in which *he cannot mention exactly where and what the difficulty is:* cannot point out any particular step, or state in precise terms the thing he does not see. It is in such dilemmas as these, where the mind gropes about in a misty vacancy, and finds itself utterly bewildered in a labyrinth of indefiniteness—where all the ideas are jumbled in one tangled mass of confusion—it is here that the real use of writing may be appreciated. The very act of writing aids in the concentration of thought. It enables the mind to exclude and bar off all extraneous notions; chronicles those which are relevant to the subject; and, to use perhaps a queer comparison, may be compared to the barrel of a gun, which prevents the power from expanding in a useless direction, and compels the whole energy to act in a definite and useful direction. At first there may be all sorts of vague and good-for-nothing ideas crossing the mind, having nothing to do with the question, and only embarrassing the view by their presence. These are got rid of. Others there may be, pertaining indeed to the subject—but wrong. By clearly stating them their inapplicability is perceived. All the notions which the student has of the meaning or connection of a process may thus be exhausted, without finding in any of them the solution sought; but this is either so much rubbish cleared away, and therefore so much indirect benefit; or, what is more likely, this attentive examination will have furnished him with the clue required, and will almost certainly be found of advantage in some part of his future progress or reading on the subject in question. It is hardly possible for attentive thought to be absolutely unrewarded. Most persons must have observed that in their endeavours to understand certain theories, or processes, or facts, objections have occurred or difficulties been seen which, although found to be beside the question or without influence on the truth of the proposition considered, have yet been of the greatest value in some way or other afterwards. This is especially the case where things are true *only under certain conditions.* The attentive examination of every possible way in which a change of conditions can alter the result, is often of the very highest importance; and though it may seem at the time that much labour and thought has been wasted, it is not so. After cases will be met with in which this very change of circumstances will occur, and the effects of such change become exactly the question to be inquired into.

(*To be continued.*)

HIGH TEMPERATURE OF MINES.
BY ROBERT WERE FOX.

The temperature of some of the deeper parts of the United Mines* has long been

* This mine, (for it is one concern,) continues to

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observed to be remarkably high; and it has greatly increased with the increasing depth of the excavations.

Captain Youren, one of the agents of the mine, imforms me, that near the eastern extremity of the deepest level, on the "*middle lode*," there is a spring or jet of water, discharging about 94 gallons a minute, at the temperature of 106½°† Fahrenheit. This level is 250 fathoms below the surface, and about 200 fathoms under the level of the sea. The "lode" has an underlie or dip of about 2½ feet in a fathom towards the north, and the water flows from its *northern* or *upper wall;* whilst from the opposite side, or *southern wall* of the lode, at the distance of only 3½ feet, there is another spring, discharging 30 gallons of water in a minute, at the temperature of 97¾° Fahrenheit. The air near both these springs was found to be at 104¼° Fahrenheit: and "*killas*" is the only rock which has been seen within 30 fathoms of them. Granite occurs at a considerable distance westward of the place; and two "elvan courses" traverse the mine in nearly the same E. and W. direction as the lode.

I have found that ½ of a pint of the water from the warmer spring contained 15 grains of saline matter, consisting of muriate of lime and common salt—in about equal proportions, with a trace of sulphuric acid, probably combined with lime. In the same quantity of the cooler water only 10½ grains of muriate of lime and common salt were found, the latter in less proportion than the former,—and in this water also there was a slight trace of sulphuric acid. In both instances, the water was clear,—saline to the taste,—and without any metallic salt.

It may, I think, be inferred from the saline contents of these springs, that they have a common origin or source; whilst their high temperatures indicate their having come from a considerable depth; and the quantity of water they discharge, that the lode, or rocks beneath, must be very pervious to it. In these instances, at least, there are no grounds for supposing that any chemical decomposition of the sulphur ores in the lode has caused the high temperature of the water, or contributed to it in any degree, seeing that it contains no metallic, and scarcely any sulphate salt.

The difference in the heat of the two springs may perhaps, in part, be attributed to the tendency of the warmer currents to rise towards the upper wall of the lode; and, still more, to that of water at a much lower temperature passing from superior strata down upon the inclined surface of the lower wall, where, mixing with the water rising from below, the temperature becomes modified, as well as the proportion of the saline contents.

It cannot be doubted that ascending and descending currents of water, more or less copious, and at different degrees of temperature, abound in the veins and fissures of the earth, and often at the junctions of different rocks, and that they must have a great influence in modifying the subterranean temperature, and in different degrees in different places.

Common salt is of rare occurrence in our mines: its presence in the water in question cannot well be attributed to the flowing of sea-water into the excavation, in consequence of its local or direct pressure; for if some miles of distance from the coasts did not render this highly improbable, the considerable streams at very high temperatures, and very constant too, (as appears from observations made at different times,) are facts not consistent with such an explanation. If the subterranean jets of water were caused by the inroads of a neighbouring sea, we should expect to find them at comparatively low temperatures, and these diminishing in proportion to the duration and amount of the influx.

The salt may, however, have been derived from the ocean, in consequence of the latter penetrating into the earth at its greater depths, or even at its lesser ones, which, under different given circumstances, it may be supposed to do. In either case, the salt water would, from its superior specific gravity, have a tendency to descend through the heated and less saline water in the veins, fissures, &c., where the fluids becoming gradually more or less mixed and extended in different directions, might ultimately appear in some of our mines, brought up perhaps, in the largest proportions, by the upward tendency of the more heated currents of water.—*Fourteenth Annual Report of the Royal Cornwall Polytechnic Society.*

produce abundance of copper ore. It is situated in the parish of Gwennap, about eight miles to the northward, or almost N.N.W. of Falmouth, and is several miles from the sea.

† The thermometer employed has been carefully compared with a standard one, and found to be ½ of a degree too high; so that this small amount must be deducted from the results, making them 106·08°, 97·5°, and 104°, respectively.

UNIVERSITY AND NON-UNIVERSITY MATHEMATICIANS, WITH A WORD OR TWO ON THE EXPENSE OF MATHEMATICAL PRINTING.

Sir,—The letter of your correspondent, "P. P.," in this day's number, complimentary and kindly-expressed as it is, with respect to myself and a few other non-

university men, might seem to imply that I had complained personally of the treatment which I have received from Cambridge men. With what you, Mr. Editor, may complain of, write, or say, I have nothing to do; and it would be most unjust for "P. P." to reply to your strictures, on any subject, in a manner which is calculated to convey the idea of their being mine.

However, I will, with your permission, make a few remarks on different points in his letter, upon which I am able to speak decidedly, because I speak from my own experience and observation. They may be of some value to certain of your readers.

1. With respect to any supposed neglect of myself, as a mathematician not educated at Cambridge (and I will state, however such a statement may be interpreted, who never enjoyed, as a mathematician, the benefit of a single hour's *mathematical* instruction from the first day of my existence to the present), I have personally every reason to speak with gratitude of the kindness and attention of Cambridge men at various periods of my life. I have found, too, that the higher the men of whom I speak, stood in the intellectual and social scale, the greater has been their courtesy, good will, and desire to aid me in any object I had in view. Nay, more, that amongst the dearest and most valued friendships I have formed in life, Cambridge men (some still resident there, and most of them retaining their early affection for *alma mater*) hold fully as high a place in my most cherished regards as any.

2. There is much truth in the remark of "P. P." (and the remark is expressed in the kindest terms that a suggestion could be), that my writings are "scattered in all sorts of periodicals;" and he asks, with much propriety and force, "how can tutors and others, who have so little acquaintance with uncommon periodicals, be expected to find them out?" The question would seem to assume that some complaint with respect to the neglect of *my own* writings has been made either by me or by some one authorized by me. I beg to state, in the most distinct terms, that I neither have made any such complaint, nor have any such to make; and that no remark of mine has authorized any of my friends to make such a complaint for me. I am *fully satisfied* with the reception which, as a geometer, the scientific public has given me: and I can only say, that it is much more gratifying than my wildest dreams of young ambition led me to anticipate. In truth, the ambition of distinction had less weight in directing my pursuits than the desire of acquiring knowledge and investigating truth. It was fortunate for me, however, that "the contest for bread and existence" (as a late eminent bibliopole once happily expressed it in a letter to me) coincided with my deepest and earliest predilections.

Still, this scattering of my "writings in all sorts of periodicals," requires explanation. No one knows better than "P. P." how few periodicals, devoted to mathematical subjects, this country has been able to maintain; or how limited the space which any one contributor could be allowed to occupy. The man who wishes to publish at all, must do so in such of these periodicals as he can obtain access to; and I am not alone in knowing that, to obtain a *few* occasional pages in these works, is esteemed very much like a personal favour on the part of their respective editors. My own practice has been simply this,—to send any speculations of my own to those particular works, their insertion in which appeared likely to bring them before those readers to whom they would be most useful or most interesting. Perhaps, if guided by a view to a condensed reputation, or even personal advantage, a different plan would have been wise; and especially as the majority of them have been published anonymously, or with signatures which, though known to perhaps a few friends, would give the public no clue to the authorship. My purpose was not reputation, but usefulness; and, if in any case I have been successful in this respect, I shall be satisfied.

When "P. P." shall have attained to my years, and have witnessed the lamentable cases that I have witnessed of pecuniary embarrassment (and even of actual ruin) which have occurred from unpatronised scientific men attempting to publish works in a separate form, which could do little towards refunding the outlay upon them, he will not blame me for not having published my papers "in a separate form." That, too, which applies to my case applies to that of other non-academic men. We do not publish our researches separately, simply because *we cannot afford to do it.* We are thankful to those editors of scientific journals who will do it for us; and you yourself, indulged me in this respect more than twenty years ago.

3. I have said, "we cannot afford to do it." Few of us have been aware, and too many are ignorant even now, of the facilities that exist for obtaining the *advantages* (and I use the term in its evident and most liberal sense) of a course of study at a proper time of life in the arrangements and endowments of the University of Cambridge. I happen to know something of these things; and I feel bound to express my

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conviction that these advantages are open to all young men of talent whose pecuniary means are even of a *very* limited order. Nor do I think it is much less at Oxford—though this is beside our purpose. I mention it in respect of Cambridge solely on account of an impression which it is calculated to make on the minds of Cambridge men, that those who have not availed themselves of these advantages are either very incompetent men, or perhaps something worse. An *impression* like this might in some degree have created an indifference towards the writings of non-academic men, under the belief that such productions *could not be worth* looking into. Would the university only take the trouble of informing the poor and ardent scholar that her endowments are open for his assistance in "keeping his terms," she would absorb a great number of gifted men who now pine and languish in obscurity and penury.

The non university mathematicians are generally such for pecuniary reasons. For the same reason they cannot afford, generally, to bring their researches before the world in a favourable shape. General statements will perhaps be less effective in enforcing this, than the illustration of special instances; with a few of which I will close this (already too long) letter.

4. Mathematical printing in this country is enormously expensive; and the purchasers of mathematical works fewer than those of any other class. On the Continent, generally, the expense is much less, and the sale vastly more ample. In addition to this, several continental governments give pecuniary aid to such publications, and especially to mathematical periodicals. Without this we should never have seen *Hachette's Correspondance*, *Gergonne's Annales*, *Quetelet's Correspondance*, *Crelle's Journal*, *Liouville's Journal*, the *Journal de l'Ecole Polytechnique*, or a host of other foreign periodicals, which contain some of the finest and most important mathematical investigations of modern times. When will a *British* minister do the like? There is not one of the existing mathematical periodicals in England that could be carried on as a matter of business, independent of other aid (or reasons for sacrifice) than the aid of the ordinary sale. I say this advisedly, for I *know*, on the best authority, that in themselves they are invariably "losing concerns." Men who carry on works like the *Cambridge Mathematical Journal*, or the *Mathematician*, deserve the highest praise for undertaking such works under the limited encouragement they receive. If devoted to more ostensible labours, their conduct would be honoured as *patriotism*. What is it now?

Again; two friends of mine, the editors of one of the works above referred to, published about five years ago a tract on some co-ordinate properties. The expenses of this work have not yet been wholly refunded to them; and the 250 copies which they printed have not been circulated, even including presents. The work itself, indeed, attracted little notice in England, and no remark; but it has been translated into German, two editions have been sold, and a third is by this time issued. German editions, I believe, are never less than 1000 copies. There is, however, this difference in the two cases: half-a-crown, supposing all the copies to be sold, would barely refund the outlay in England; whilst in Germany the expense to the buyer would barely exceed one-fourth of that sum, whilst it left fair gains to the translator and the booksellers.

I may add one case more, to show that even in the hands of the publishing houses, mathematical works are by no means lucrative, or even safe speculations, viewed as a matter of business. Of a single volume of a mathematical work, with which I was editorially connected, 2,000 copies were printed, and the expenses, without any charge for copyright, and but small for editorial assistance, were a shade under 700*l.* To an author publishing by commission, they would have been at least 850*l.*; for this was what is called "a trade book." The work was sold to the public at twelve shillings; and as "the trade allowance, commission," &c., is in all cases upwards of 30 per cent, the returned proceeds of this volume, supposing *all the copies sold*, would be something less than 840*l.* Take out of this the expenses of advertisements, warehousing, the wages of business hands, &c., then what will be left as "business-profits?" Scarcely the legal interest of the money invested in the undertaking. No compensation, certainly, for business risks, such as losses and failure of selling. This fact, itself, ought to show some authors, who are very wroth with the supposed "hard heartedness" of publishers, that this class of persons exercise a proper degree of business-caution when they offer only small sums for certain works, or even decline them altogether. As business-men they act prudently "in fighting shy" of mathematical works, except under peculiarly favourable circumstances for the sale of individual ones. This, too, enables me to answer, once for all, a question that has often been put to me,—"When will the third volume of Hutton's Course be out?" It is simply

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that the other volumes have been too slowly sold to justify, at present, any further outlay on the work.

Into any disputes respecting Cambridge men or Cambridge studies, I have no inclination to enter. I cannot, however, conclude, without sincerely thanking your correspondent for his frank expressions of good will; and adding, at the same time, that his letters betoken a high and generous freedom from all the mental shackles and mean prejudices for which Cambridge men have been often censured: prejudices which my own experience convinces me are seldom found to exist amongst any but the lowest order of minds that pass through the university.

T. S. DAVIES.

Charlton, near Woolwich, April 17, 1847.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS: FROM THE PERIOD WHEN THE PRACTICE OF INROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 382.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

John Horsley, the Elder, of Haberdashers' Walk, Hoxton, founder and brazier: of a new method of making plated furniture for fire stoves and grates, with or without glass ornaments. Cl. R., 24 Geo. 3, p. 2, No. 16. Nov. 15, 24 Geo. 3; March 13, 1784, 24 Geo. 3.

Martin Vanbutchell, of Westminster, surgeon dentist: for new spring bands or fastenings for the apparel or furniture of man or beast, which bands or fastenings, by their certain re-action or small friction, are more easy, safe, or lasting, than any other bands or fastenings. Cl. R., 24 Geo. 3, p. 2, No. 11. Dec. 1, 24 Geo. 3; March 29, 24 Geo. 3, 1784.

William Storer, of Great Marlborough-street, gent.: of a new and peculiar method of preparing and making of optic glasses, called (by the specifier) Syllepsis Glasses, and also the application thereof to optic instruments, whereby distinct vision is more readily procured and the sight greatly relieved, and by which said preparation optic glasses are rendered more perfect, and may be applied with greater certainty. Cl. R., 24 Geo. 3, p. 2, No. 9. Dec. 12, 24 Geo. 3; April 10, 24 Geo. 3, 1784.

John Stedman, of Princes-street, Soho, buckle maker: of new constructed fastenings for shoe buckles, knee buckles, stock buckles, and all other kinds of buckles whatsoever, which are so constructed as to render them stronger, cheaper, and of more utility than any other buckles or fastenings yet invented. Cl. R., 24 Geo. 3, p. 2, No. 8. Dec. 19, 24 Geo. 3; April 16, 24 Geo. 3, 1784.

Alexander Sparkhall, of Crutched-friars, London, blacksmith: of a new constructed machine, better calculated for the safely escaping from houses, in case of fire or thieves, than any other heretofore discovered. Cl. R., 24 Geo. 3, p. 2, No. 7. Dec. 19, 24 Geo. 3; April 7, 24 Geo. 3, 1784.

Robert Cameron, of Clerkenwell, engineer, of certain methods of making or constructing a steam engine, commonly called a fire engine, the principles whereof consist, 1st, in making steam act on a spiral or helical surface or surfaces winding round an axis: 2ndly, in pressing a circular vessel round a piston, or in pressing a piston, not fixed to an axis, round in a circular vessel, or regular channel returning into itself by steam: 3rdly, in the new methods of discharging the condensed steam, condensing water and air, from the said engines. Cl. R., 24 Geo. 3, p. 2, No. 2. Jan. 17, 24 Geo. 3; May 15, 1784.

Francis Moore, of Cheapside, linen-draper: of a four-wheeled carriage upon a new construction; more commodious, easy, and safe, than any hitherto known or made use of. Cl. R., 24 Geo. 3, p. 2, No. 1. Jan. 28, 24 Geo. 3; May 18, 24 Geo. 3, 1784.

Michael Nash, of Homerton, gent.: of an invention for making blacking, which effectually resists moisture, prevents all kinds of leather from growing rusty or mouldy, and preserves it from pernicious effects of salt water. Cl. R., 24 Geo. 3, p. 3, No. 8. March 10, last; July 9, 24 Geo. 3, 1784.

John Barrett, of the Haymarket, wax chandler: of an invention of a new constructed chandelier, girandole, and lustre [whereby the candles are prevented from damaging furniture, apparel, &c., either by fire or the wax dropping. Nosles are likewise used with large cups to receive water and prevent the wax from dropping]. Cl. R., 24 Geo. 3, p. 3, No. 7. March 12, 24 Geo. 3, July 10, 1784.

Wolfgan de Kempelen, of St. James's, (Middlesex,) esq.: of a re-action machine set in motion by fire, air, water, or any fluid, and applicable to any other machine or engine requiring a moving power in any direction whatsoever, being more simple in its construction than any machine yet known, and producing effects equal to any at a much less expense. Cl. R., 24 Geo. 3, p. 3, No. 1. April 10, last past; July 21, 24 Geo. 3, 1784.

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Samuel Arnold, of Great Pulteney-street, Westminster, doctor in music: of an invention of printing vocal and instrumental music of all kinds with types, in a neater and more expeditious manner than hath hitherto been used. Cl. R., 24 Geo. 3, p. 4, No. 4. May 19, 24 Geo. 3; Sept. 16, 1784.

John Richmond, of Holborn, gent.: of an invention of a candlestick with a socket or nosle to fit candles of various sizes without using paper, and which may be applied to candlesticks already made. Cl. R., 24 Geo. 3, p. 5, No. 13. July 3, 24 Geo. 3; Nov. 1, 1784.

Jean Philippe, of Rupert-street, Westminster, spring maker: of a spring or springs made of tempered steel, either flat or square, upon a principle entirely new, which is thinner, more supple, and fitter to be used for garters, bracelets, boots, buckles, sashes, stays, and jumps for ladies, sword and other belts, binders for letters and bandages of every sort; also buckles for breeches and waistbands. Cl. R., 24 Geo. 3, p. 5, No. 7. July 20, 24 Geo. 3; Nov. 19, 1784.

Benjamin Partridge, of Halesowen, (Salop.) manufacturer of wick yarn: of certain engines or machines for the purpose of spinning and carding short tow, commonly called hurds. Cl. R., 24 Geo. 3, p. 7, No. 17. Oct. 3, 23 Geo. 3; Jan. 27, 24 Geo. 3, 1784.

(*To be continued.*)

REID'S IMPROVEMENTS IN THE MANUFACTURE OF ELECTRO-TELEGRAPHIC WIRE.

[Patent dated 29th October. 1846. Specification enrolled 29th April, 1847.]

The introduction of the electric telegraph has rendered it an object of greater importance than it ever was before, to obtain wire of great lengths, and of an equal diameter and quality throughout. When Messrs. Cooke and Wheatstone first began their operations, the ordinary weight of iron wire bundles, averaging about 192 feet in length, did not exceed 14 lbs.; and it must have taken, therefore, more than 27 such bundles for each mile of telegraph, involving as many risks of failure as there were bundles; for the bundles had to be welded together at the ends, and the united wires were almost always not only thicker at the welds or joints than elsewhere, but more brittle, and very often unsound. By the invention, which is the subject of the present patent, wire can be manufactured in bundles of upwards of 100 lbs., or, indeed, of any required weight and length. It consists, so far, in simply welding together (end to end scarfwise) the rods of iron *before* they are drawn into wire, and then passing them through the drawing machine, whereby the whole is not only produced of one uniform diameter, but any defects in the welding are instantly detected (through the strain required by the drawing process). Another valuable portion of this invention consists in an improved mode of preparing the wire for being coated with zink, to protect it from oxidation, or, as it is commonly termed, being galvanized. Hitherto it has been the practice to cleanse the wire by immersing it, or otherwise subjecting it to the action of sulphuric acid, or nitric acid; and it has been often much injured in structure from the acid not acting equally on all parts of the wire alike, or from some parts being longer exposed to its action than others. Mr. Reid dispenses with the use of acid altogether, and effects the cleansing wholly by mechanical friction. By an ingenious system of machinery, which is described at length in his specification, he cleanses from six to twelve lines of wire at a time, and not only with immense rapidity, but with a degree of perfection wholly unattainable by the acid process.

LIST OF ENGLISH PATENTS GRANTED FROM APRIL 22 TO APRIL 29, 1847.

Theodore Hyla Jennens, of Birmingham, manufacturer, for an improved method or improved methods of manufacturing papier maché articles, also a new or improved method of ornamenting papier maché articles, which said method of ornamenting papier maché articles is also applicable for ornamental purposes generally. April 24; six months.

John Morgan, of East Greenwich, manager, for certain improvements in machinery applicable to preparing and spinning flax and hemp, and other fibrous substances. April 27: six months.

Jonathan Atkinson, of Liverpool, soap boiler, for a new method of manufacturing soap. April 27; six months.

Caroline Watson, of Chorley, of Lancaster, for improvements in apparatus for filtering. April 27; six months.

Alfred Vincent Newton, 66, Chancery-lane, Middlesex, mechanical draughtsman, for certain improvements in the construction of roads or ways, and in the carriages to be used thereon. April 27; six months.

Thomas Denne, of Bermondsey, Surrey, strap manufacturer, for improvements in the manufacture of grease, or compositions for atmospheric pipes, and for lubricating the axles and moving parts of machinery. April 27; six months.

John Coates, of Seedly, of Lancaster, calico printer, for improvements in machinery, or apparatus for cleaning the surface of woven fabrics, or freeing the same from fibrous or other loose matters previous to printing thereon. April 27; six months.

George Thompson, of Nottingham, cabinet maker, for improvements in machinery for sawing wood or other substances. April 27; six months.

Marie Malanie d'Hervilly Hahnemann, of Rue de Clichy, Paris, and Henry Petitpierre, of Place du Chateau Rouge, Paris, for improvements in instruments for writing. April 27: six months.

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Robert Broad, of Tipton, Stafford, engineer, for improvements in railway turn tables. April 28; six months.

Richard Archibald Brooman, of the patent office, 166, Fleet-street, patent agent, for certain improvements in railway turn tables. (Being a communication.) April 29; six months.

William Carter Stafford Percy, of Manchester, for improvements in machinery for making and dressing bricks and tiles, and in certain sheds and kilns, in which bricks and tiles are dried and burnt. April 29; six months.

John Spear of Gloucester-road, Hyde Park-gardens, gent., for improvements in piano fortes, and in the musical scale of notes in use for such instruments, and also in apparatus to facilitate the action of fingers on the keys of piano-fortes. April 29; six months.

LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 3RD OF FEBRUARY TO THE 22ND OF MARCH, 1847.—(CONCLUDED FROM P. 407.)

Henry Henson, of Hampstead, in the county of Middlesex, gentleman, for a new fabric, suitable for goods, wrappers, waggon covers, and other like purposes, and certain processes employed in the manufacture of the same. March 5.

Robert Stirling Newall, of Gateshead, Esq., for certain improvements in locomotive engines. March 5.

John Wood, of Leeds, machine-maker, for certain improvements in machinery for spinning fibrous substances. March 8.

George Lowe, of Finsbury Circus, civil engineer, for improvements in the manufacture of and in burning gas, and in the manufacture of fuel. March 9.

James Roose, of Darlaston, tube manufacturer, for improvements in the manufacture of welded iron tubes. March 9.

Charles Richardson, in the county of Middlesex, gentleman, for certain improvements in making and refining sugar, and in the application of the products of the sugar cane to manufacturing purposes, and also in the machinery and apparatus employed therein. (Being a communication from abroad.) March 10.

Albert Robert Cunningham, of Sydenham, Kent, gentleman, and Joseph Threlfall Carter, of Sydenham aforesaid, engineer, for certain improvements in propelling carriages on railways. March 22.

William Newton, of 66, Chancery-lane, civil negineer, for certain improvements in engines to be worked by gas, vapour, or steam, either separately or in combination. (Being a communication from abroad.) March 22.

Charles Fox, of No. 3, Trafalgar-square, engineer, for improvements in the construction of presses in shearing, cutting, or punching pieces of metal, in welding or uniting pieces of metal together, and in pressing or forming pieces of metal into forms or shapes. March 22.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
April 28	1045	Joseph Ridsdale	54, Minories, London	Signal lamp or lantern.
,,	1046	Samuel Backler	4, Cambridge-terrace, Islington.	Spatula
,,	1047	Felix Abate	London	Elastic wheel for railway and common carriages.

Advertisements.

Patent Carriages.

MESSRS. WHITEHURST and Co. have secured a license from Mr. Thompson, (the Patentee of the "AERIAL WHEELS,") to fit them to every description of carriage. These wheels give carriages a gentleness of motion quite unattainable by any kind of springs whatever. They entirely prevent the carriage making any noise; they prevent all jarring and jolting, and the draught is considerably less than common wheels, particularly on bad roads. Messrs. Whitehurst and Co. have fitted up a brougham with the "Aerial Wheels," in order that gentlemen desirous of trying them may have an opportunity of doing so.—313, Oxford-street, near Hanover-square.

H. ELLIS,

MACHINIST and MODELLIST, of 9, Three Kings Court, Lombard Street, begs to acquaint those engaged in Mechanical Arts, either as practical men, inventors, or amateurs, that he executes orders for models of inventions and apparatus for experimental purposes; also in wheel and screw-cutting, ornamental, spiral, and general turning, and for optical, mathematical, and philosophical instruments, with precision, neatness, and economy.

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INVITE the attention of Engineers, Machinists, Mill Owners, &c., to the PATENT GUTTA PERCHA DRIVING BANDS, which possess the valuable properties of great durability and strength, permanent elasticity, and uniformity of substance and thickness, thus avoiding all the irregularity of motion occasioned by piecings and inequality of thickness of leather straps. They are not affected by fixed Oils, Grease, Acids, Alkalies, Water, &c., and possess extraordinary facilities for being joined, and hug their work in a remarkable manner. Can be had of any width, substance, or length, without joints.

The Company continue to receive most satisfactory Testimonials of the superior quality of these Bands, which can be seen at the Company's Works, Wharf-road, City-road, where all orders will receive immediate attention.

E. GRANVILLE, Manager.

London, March 3, 1847.

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For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d*.; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

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APPLICATIONS for Licenses to be made to Messrs. T. Burnell and Co., 1, Great Winchester-street, London.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

NOTICES TO CORRESPONDENTS.

A. B. asks—"Whether on a patent article being thrown open to the public by the expiration of the patent, persons making the same have a right to mark them with the name of the Patentee, say, for instance—'Johnson's Patent,' or 'Thompson's Patent?'"—We think they are perfectly at liberty to do so. In the Act of 5 and 6 W. 4, c. 83, which imposes a penalty for using unauthorized the name of a patentee, there is a proviso expressly excepting "the stamping and marking the word Patent *upon anything made, for the sole making and vending of which a patent before obtained* shall have expired."

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W.C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

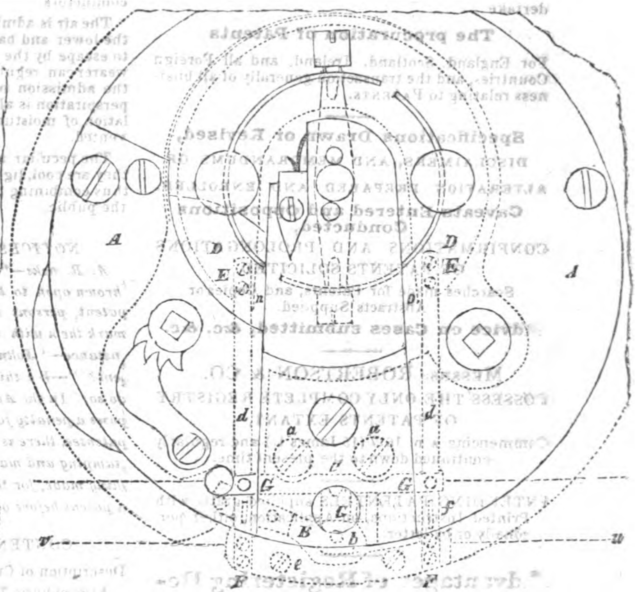
No. 1239.] SATURDAY, MAY 8. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

HUTTON'S PATENT IMPROVEMENTS IN CHRONOMETERS AND OTHER TIME KEEPERS.

Fig. 4.

Fig 1.



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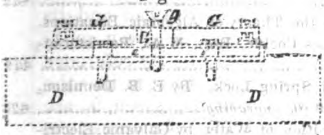

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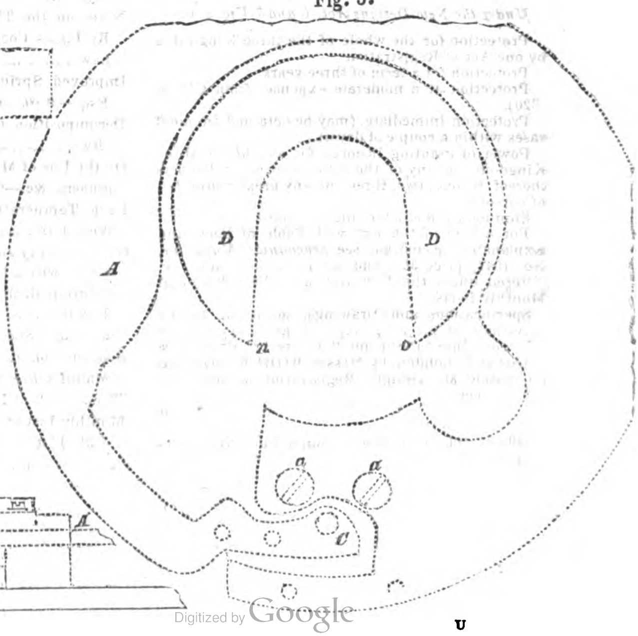

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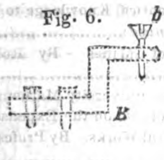
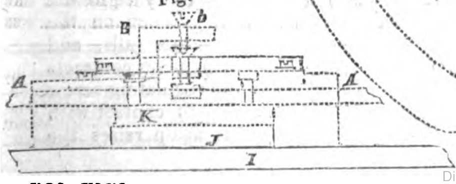


Fig. 7.

Fig. 2.



HUTTON'S PATENT IMPROVEMENTS IN CHRONOMETERS AND OTHER TIME-KEEPERS.

[Patent dated October 22, 1846. Patentee John Hutton, of Commercial-road, East. Specification enrolled April 22, 1847.]

Mr. Hutton is the gentleman whose chronometer held the first place in last year's competition at the Royal Observatory, Greenwich, and who would have received the first prize had the old practice of awarding prizes been still in force. From the prevailing character of the improvements, eight in number—which form the subject of his present patent—we may infer that he owes his success, as a maker, mainly to his skill in compensating or counteracting the various influences which are calculated to interfere with correct time keeping. All of them, with one exception, have compensation in one way or other for their object; and all of them are distinguished for uncommon delicacy and precision.

The *first* is intended to correct an error common to all chronometers as ordinarily constructed, which is known by the name of "the error in extremes" (of temperature). As chronometers are required in all latitudes, and are subject consequently to the greatest extremes of temperature, it becomes obviously a matter of great importance to remove, or even to lessen, in any degree that error. Mr. Hutton employs for this purpose an auxiliary compensation, which may be put on, or taken off without stopping the balance, and is therefore equally applicable to good old, as well as new chronometers. It is constructed on the principle of diminishing and increasing the resistance of the atmosphere to the motion of the balance in proportion as the temperature either rises or falls, and thereby maintaining a greater uniformity of rate. In figures 1, 2, 3, 5 and 6, the full lines represent parts of a chronometer as usually made, and the dotted lines, the parts belonging to Mr. Hutton's auxiliary compensation. Figure 1 is a top plan of the chronometer (supposing the face to be turned downwards), and figure 2 a cross section on the line *v w* of as much of it as is above the upper plate I of the movement. A A is a metallic thermometer, or compound piece of brass and steel, or of any other two metals subject to different degrees of expansion (constructed on the well-known principle of the compensation balances), which is made fast at one end to the foot of the cock J, by means of the two screws *a*, *a*. A plan of this thermometer is given separately in fig. 3; B is a small cock with an adjusting screw *b* (shown separately in plan and section in figs. 6 and 7), which is attached to the free end of the thermometer A; C is a flat ruby or other hard stone fixed to the free end of the thermometer; D D is a light cap or lid made of box-wood, or other suitable material which nearly surrounds the balance, the part of it from *n* to *o* being cut away, in order to free the cock and balance spring. The interior of this cap forms the air space of the balance. It is attached by two arms *d d* to a piece *e*, fixed on the fast end F F of the thermometer A. At the points *f f* these arms are made much thinner than at any other part, and have also pieces cut out of them in order that the cap may have its centre of motion at those points. G G G is a triple branched cross piece fixed to the arms *d d*, and *g* is a regulating screw. H is a ruby or other hard stone fixed in the extreme end of the centre branch of the cross-piece G. A plan and section of the cap and its immediate appendages are given separately in figures 4 and 5. By reference to the engravings, it will be seen that the cock B, and its regulating screw *b*, are on one side of the centre of motion (*f*), of the cap D; while the part of the cross-piece G, that carries the regulating screw *g*, is on the other side of it. The action of the apparatus therefore, is as follows: At first the cap rests on the upper plate I, and shuts up (as it were) the balance. When the temperature rises, and the free end of the thermometer (A) expands with it, the ruby C, coming in contact with the point of the regulating screw *g*, gradually raises the cap from off the balance, and thus gives more freedom to the air around it, and consequently diminishes the resistance to the motion of the balance. When on the other hand, the temperature falls, and the free end of the thermometer contracts with it, the point of the regulating screw *b*, of the cock B, comes in contact with the ruby H, and this again raises the

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cap and causes a corresponding diminution of resistance to the motion of the balance.

Mr. Hutton's *second* invention has for its object to correct the error in astronomical and other clocks, arising from changes in the density of the atmosphere. He employs for this purpose a barometer, in which the rising and falling of the mercury is made to serve as a motive power, whereby to enlarge or contract the air-space of the pendulum according to the increase or diminution of barometric pressure. When the mercury rises, the air-space is enlarged, and when it falls, the space is contracted. The manner in which this is effected is shown in fig. 8. A A A represent a portion of the interior of the case of an astronomical clock, the lower part of which may be called the air-space of the pendulum. The barometric tube *a a* is

Fig. 10.

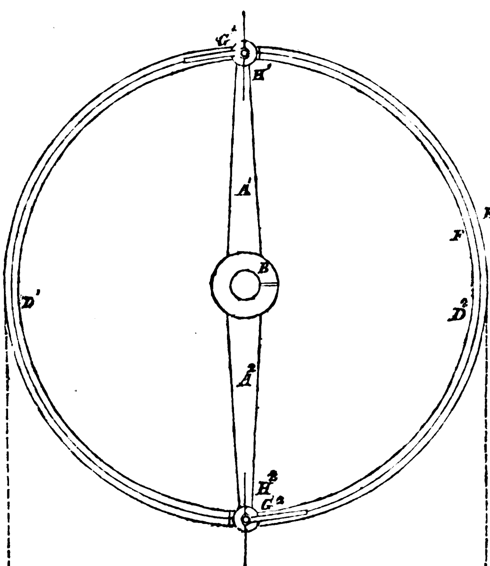


Fig. 9. Fig. 8.

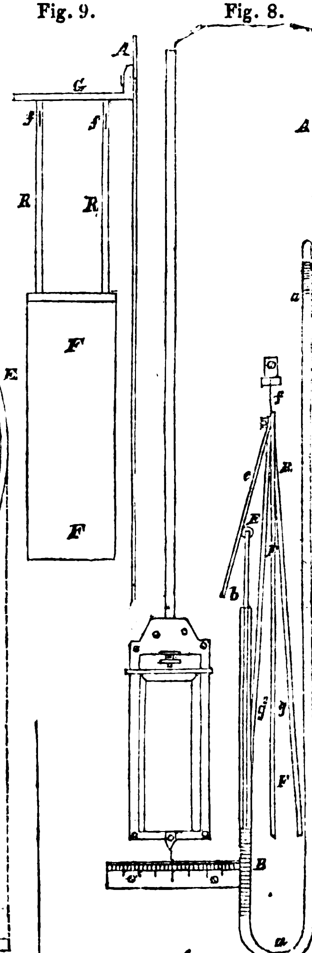
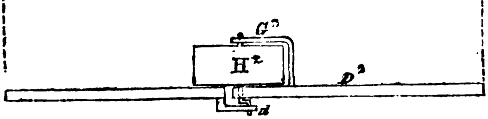


Fig. 11.



fixed to one side of the case. B is a piston or float, to which is attached a light rod *b*, the upper end of which, E, may be either made sufficiently smooth and hard to bear a slight degree of friction, or have a friction roller attached to it. F F is an air resister, consisting of a plain surface, suspended by spring rods, R R, from a projecting bracket in the back of the case, as more clearly shown

in the side view, fig. 9; *e* is a smooth inclined plane, which is fixed in an angular position to the top of the plate F, and projects over the short end of the barometer, so that the top point (or roller) E of the piston-rod may, on rising perpendicularly, catch against the inclined plane. The effect of the springs attached at *f f* to the hanging rods R R, is to throw the plate F in the first instance into the position indicated by the dotted line *g*; but as the mercury rises, and the piston-rod *b* rises with it, the point E of the latter presses against and throws out the inclined plane, which causes the plate to approximate gradually to the position of the second dotted line, g^2, and thereby to diminish the air-space of the pendulum. As the mercury falls, a reverse operation of course takes place.

A *third* improvement consists in a compensation spring stud for watches, which is formed by connecting two or more compound or compensation pieces with two or more springs, in such manner that the compound pieces shall act in opposition to one another, and strengthen or weaken the stud spring, or springs, according as more or less strength is required by the variations of temperature.

An improvement in the "two-pin lever escapement" forms the *fourth* improvement. It consists in inserting a solid piece of ruby or other hard stone in the roller, and in placing the impulse-notch in this ruby, and forming the lower part of the ruby so as to receive the fork of the lever.

The *fifth* head of Mr. Hutton's invention embraces two compensating pendulums of a new description.

The *sixth* improvement consists of a compensating collet, which is intended to be attached to the balances of chronometers. A^1 A^2, fig. 10, are the arms of the collet, which rests on the top of the balance, and is slipped on to the same spindle; B the boss; D^1 D^2 are two compound pieces of metal, formed each of a piece of steel E, and a piece of brass F, which pieces D^1 D^2 are each securely fixed at one end to the arms A^1 A^2, leaving their free ends at liberty to expand outwardly from, or contract towards, the boss B, according as they may be acted upon by any variation of temperature. G^1 G^2 are two frames, situated in close proximity to the fixed ends of D^1 and D^2. H^1 H^2 are valves placed within the frames G^1 G^2, which, in the first instance, present their flat surfaces at right angles to the line of rotation or vibration of the spring collet, as represented in fig. 10; and in that position the pin *a*, fig. 11, of a small crank formed on the lower ends of the separate spindles, upon which they vibrate within the frames, G^1 G^2 takes into a slot formed in the free ends of the pieces D^1 D^2. The crank of H^1 takes into the slot in D^2, and the crank of H^2 takes into the slot in D^1. As D^1 and D^2 bend either outwardly or inwardly from the boss B, the valves are correspondingly turned round, and in either direction they present less resisting surface to the air with which they are surrounded, and thereby effect an uniform rate. Instead of attaching the parts just described to a spring collet, they might be attached to the balance.

The *seventh* part of Mr. Hutton's invention consists of a compensation collet, or attachment, applicable to timekeepers in which a balance and spring are used.

The *eighth*, and last, consists in a method of compensating in clocks for variations in the density of the atmosphere, which may be briefly described as being the converse of that before mentioned as constituting the second part of the invention; that is to say, instead of enlarging the air space of the pendulum, he in this case diminishes or enlarges the sectional area of the pendulum, and thereby causes it to meet with a greater or less atmospheric resistance, according as the barometer may rise or fall.

ON THE THEORY OF GALVANIC ACTION.

Sir,—I am glad to find that the observations which I ventured on this subject have proved of any interest. In answer to Mr. M'Gregor's note, I take this opportunity of mentioning, that shortly after my communication I found from an article in the *Annales de Chemié et Physique*, for March of this year, that the experiment on interference of electrical vibrations has been tried, and that, too, some years ago, though not brought fully before the public till now. As I have not the article by me, I cannot give any satisfactory account of it; a translation of it appeared in the last number of the *Phil. Mag.* ("On Volta-Electric Induction," by M. Elie Wartmann). The experiment did not

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succeed in showing any interferences, but the experimenter himself seems fully aware of the numerous causes which might prevent the obtaining of so delicate a result. The means used for the exhibition of such an effect was of course the galvanometer; and to obtain the difference of route between the two currents, the induction of the secondary current was employed. I cannot trust myself to give a correct account of the matter from recollection; but to the best of what I do remember, it was thus: A coil of wire wound round a cylinder being taken as the secondary coil, that with which the galvanometer is connected, two other helices were superimposed to act each as a primary current, being of course connected with the battery. If these two primary coils were made the conductors of *equal* but *contrary* currents, the effect on the secondary coil would be zero—one current counteracting the effect of the other, and consequently no deflection of the needle. By "*differentiating*" (to use M. Wartmann's expression) the energy of one of these inducing currents he hoped to obtain the phenomena of interference, and to have the result indicated by the galvanometer. There are obviously several ways in which the energy of the current may be "differentiated," *i.e.*, caused to increase or diminish by imperceptible gradations—that is there are, *theoretically*; but to obtain this *practically* is the great difficulty, and one requiring the best efforts of the most skilful and sagacious experimenter. Some one it appears had tried the experiment before M. Wartmann, and his plan was to pass from one wire to another "rather larger;" this, as M. Wartmann remarks, was a very rough way of going to work. The same battery must, of course, be used for both coils, or there could be no certainty at all. The difficulties noticed by Mr. M'Gregor must be combatted by the experimenter as well as he can. Melloni's thermo-multiplier is an extraordinarily delicate instrument, and the French experimenter no doubt well acquainted with its usage. His wires must be made as homogeneous, and the electric currents maintained with as much "constancy," as the present state of apparatus will allow; but how far all these things may combine to nullify the result which the simpler conditions of optics permit to be attained is left for us to conjecture.

There is great room, however, for doubting whether the principle relied upon by M. Wartmann be not altogether inapplicable. As yet we know absolutely nothing of what really constitutes this *induction* of secondary currents. All we know is the fact. The effect, however, looks very much like the usual effect of *inertia*—and this view must have occurred to most persons. Let us just call to mind the facts. Take two wires, one tolerably thick and the other much thinner—form both into helices—bring them as near to each other as possible, without actual metallic contact (this is generally, and most easily done, by covering the wires with cotton or silk, and wrapping one on a cylinder and the other on the first)—now connect the two ends of the thicker coil, or helix, with the battery, and at the very instant this is done, a current is originated in *the opposite* direction in the other, which effect is perceived by connecting the ends of this second helix with a galvanometer—the needle is suddenly deflected. Whilst the current continues in the primary coil, the needle, having returned to its original position, remains there perfectly indifferent to what is going on—the instant, however, the current is stopped, off it starts again, *but in exactly the opposite direction to its first motion.* Now what can be more strikingly analogous than the similarity of this effect to that exhibited in the communication of motion to bodies at rest, or *vice versâ?* For example, a person sitting in a carriage at rest, falls backwards on a sudden start of the horses forwards (current produced in *opposite direction to primary* one), and recovering his position, retains it while the carriage moves on (needle returns to, and remains in its original position), but falls forward on the sudden stoppage of the horses (current in *same direction* as primary one on breaking battery contact in first wire). Now *analogies* in natural phenomena are by no means *mere coincidences.* The idle man may stare and exclaim, "Singular coincidence!" but the rational inquirer knows nothing of such singularities, and sees only the acquisition of a new instance of an old law—a particular case of a general one.

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Other similar facts in electricity are, the attractions and repulsions of "electrified" bodies; the electrical wave from a stick of rubbed wax, for example, giving rise to motion of light bodies in the *opposite* direction, or the *positive* charge (motion in one direction) inside a Leyden jar producing the *negative* (motion in opposite direction) on the outside. Nay, have we not in the motion of air itself, and on a large and visible scale, similar motions to those here ascribed to electricity—the simple experiment of Leslie, quoted in a former communication of mine in this Magazine—is it not "very like" the sudden start of the "electrified body"—the cause in all cases being a sudden alteration of pressure in an elastic fluid? If, then, the induction of secondary currents be merely the usual effect of inertia, since it is necessarily only an instantaneous one, there may be no possibility of the existence of interferences. Suppose, for instance, one of the inducing coils to be capable of producing a deflection through 20°, and the other through 19°, these being in opposite directions will give a resultant deflection of one degree; but then the whole effect ceases, and, consequently, even though the two currents should afterwards go through a series of variations, such that if they were two waves of light in the same medium, they would interfere, it does not appear from the experiments with the galvanometer that any such effect could be made manifest *by it*. This question, in fact, arises—how is it, that in the ordinary experiments with one primary and one secondary coil, seeing that the battery current is sure to be variable, the needle itself is not affected by the variableness? Why are there not a series of oscillations varying with the variable current? The only answer seems to be, that this *variation* is generally *uniform and continuous*.

A. H.

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

(Continued from page 427.)

The subject last alluded to, namely, the examination of the *conditions* under which certain propositions are true, is one of the most important in mathematical reading. It is the very great neglect of this examination which causes that loose and irrational way of "getting up" subjects which is so common. A proof may be got up so as to be written out in literal accordance with the book; but directly any application to problems is required, the nakedness of the land is discovered. Nay, more than this, the proof may be so far understood, that no objection can be offered, and it may be therefore received with that "imperfect faith" which sees half and believes the whole—cannot see *why* it should be so, nor *why* it should *not* be so. Now, if the several conditions of every proposition were carefully looked into, not only would the validity of the proof be perceived, but it would be seen *how* the whole is brought about—how much depends on this condition, and how much on that,—in what way the reasoning would fail if such a condition were taken away, and how it might still be true if another circumstance were absent. It is this distinct perception of the part to be attributed to each element of the question,—the allotting of the separate functions, and the combination of separate effects into one final result,—it is this which constitutes the *understanding* of a process.

It would not be a bad plan in some instances—especially where there is any indistinctness of view as to the conditions—to set to work and attempt to prove that the proposition is *not* true. By such an attempt the truth would come to light. A very frequent source of error to the beginner in every branch of mathematics, is the very imperfect view he has of the *generality* of the theorems proved. He is apt to confine his thoughts to the particular data of the question, and to imagine that what is said applies only to his own limited suppositions. For example, in so simple a thing as the proof that $\cos^2 A + \sin^2 A = 1$, he attaches such notions to (A), that when afterwards he sees it assumed that $\cos^2\frac{A}{2} + \sin^2\frac{A}{2} = 1$ also, he may be surprised, and not improbably set it down as a glowing untruth, arguing, perhaps, "if true for A, it *cannot* be so for half A." If he had written down the above formula in *words*, (cosine of *any* angle)^2 + (sine of same angle)^2 = unity, he would see at once that the particular size of the angle had nothing to do with it—was not, in fact,

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one of the conditions of the proof. Or, to take another instance, there are, no doubt, many persons who, after going through the investigation in statics, for the conditions of equilibrium of a rigid body, and arriving at the six equations necessary, on coming afterwards to the enunciation in words of these algebraical results, have perhaps been surprised to see that *any* three rectangular lines, meeting in a point in the body, or rigidly connected with it, may be taken as that to which the moments, &c., are referred.

Notwithstanding all the efforts made, there will be things left in obscurity if the student has no one to consult. In such cases he must take the advice of D'Alembert:—"*Allez en avant et la foi vous viendra.*"—"Go on, and confidence will come to you." That is, the acquaintance with what comes after will throw light on the preceding; but here it must be again repeated, that there is danger of receiving *on trust, and not recollecting* that it was so *merely* on trust. There is great risk of that which was received *provisionally* becoming so familiar by habitual use, as to lose its character of a mere assumption. If such gratuitous assent is necessary, some means of marking and branding it as an unwelcome intruder should be taken, otherwise it will prove an insidious foe. I need hardly say, that the constant working of examples and problems is the only way of acquiring knowledge, really worth anything. Most especially is this true in mechanics. It was by the discussion of numerous problems that the science itself was formed. The Bernoullis, Huyghens, Clairaut, D'Alembert, and, above all, Euler, were incessantly problem-solving. By varying the conditions of each case—by gradual extension of particular results; by this slow and growing process was obtained that generality which now characterizes the science. And in the same way as it was slowly and laboriously built up, must the mind of the student be conducted from the simple example to the general and abstract theory. Of course, he has an immeasurable advantage in the labours of others presented to him; but this will not dispense with his going through a similar course, though it will accelerate his progress.

There is a sad want of good collections of examples worked out, and even of the bare questions themselves. The reason is easily enough found. Where there are a hundred men who, by cabbaging from others, can manufacture an "elementary treatise," there is not one who is capable of producing a good serviceable collection of problems, solved as they ought to be. Walton's *Mechanical Problems* is the only one on this subject that I know of. This the student, who is a little advanced, will find extremely valuable, but there is not a sufficient number of the easier examples for those just commencing. Some of this sort (with their answers, but not solutions) will be found in a useful collection by Messrs. Wrigley and Johnstone, which comprises examples in most of the elementary branches of mathematics. It would have increased the value of the book if rather more care had been taken in stating the problems; for in this, as well as in so many other cases, it is often as difficult to find out what the problem is intended to mean as to solve it when found out. Some tolerably easy problems will be found solved in *Earnshaw's Statics*, and various others may be got from the older books, as *Bridge's Mechanics*, &c. *Bland's Philosophical Problems* and *Mechanical Problems* contain a large quantity, selected from the *Cambridge University Papers*, but without any answers, and so are of little use to the student. I have often wondered there are no French collections on this subject. Surely, problems must be constantly proposed at the "Ecole Polytechnique," (or else their training is not good for much); but the only two books containing any questions at all, that I know of, do not contain a single example in mechanics.

We come now to the consideration of Mechanical Principles. So far as the theory is concerned, there is little that can occasion any difficulty in the statical part of the subject. The practical application of the conditions of equilibrium, of course requires the consideration of the structure and strength of the materials used; and this at present is but very partially understood.

The properties of "moments" of forces is perhaps the only portion of statics requiring any further notice than may be found in the usual treatises; but this admits perhaps of illustration, better from dynamical considerations than statical. However, we may remark, that their

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properties are *proved*, and the conditions of equilibrium of a body subject to their action obtained, by *indirect* means, in every work and method of treating them. The reader must have observed that, in order to get at the results, new forces were supposed to act: these are such as not to alter the equilibrium, certainly, provided the body be perfectly rigid; but they are, nevertheless, altogether extraneous and foreign to the question, inasmuch as they were not originally contemplated. Before we could see *how* these effects are produced, we should have to examine how the property of *rigidity* influences the result: in fact, it is a question as to the *transmission of force* from one particle of a rigid body to another. We make use of certain results of this property of rigidity in the very supposition that the application of new forces will not alter the arrangement of the particles.

Even Poinsot has left this point without any elucidation. He has *proved*, indeed, that the effect of a "couple" is measured by its momentum; but this proof requires the introduction of new forces, by combining which with the original ones, the result is obtained; but we are as much in the dark as ever with regard to the seeing *how* and *why* the increase of distance between the two forces should increase the rotary effort. In a note to the second edition of *Pratt's Mechanical Philosophy*, the conditions of equilibrium of a rigid body are elegantly deduced from those of a single molecule; but the process involves the elimination of the unknown molecular forces, by aid of analysis, without throwing any light on the real difficulty. At first sight, there appears to be in this increase of effect from mere increase of distance between the acting forces, a *gain of power*, which is explained by most writers by saying, that what is gained in power is lost in time. This is very easily seen if *motion be supposed*, but when everything is absolutely at rest, this dictum falls to the ground at once. Take, for a simple example, the lever. How can we explain the fact, that a weight of 10 lb., at one foot from the fulcrum, will counterbalance 20 lbs. at half a foot (everything being supposed at rest) without admitting an absolute *gain* consequent on increase of distance? Not one syllable has ever been written capable of explaining this. If, indeed, the state of rest be considered as the limit of gradually diminishing motion, then the ordinary explanation will do. For, so long as there is any motion at all, the greater mass moves with a proportionably less velocity. Here then, we find recourse to dynamical considerations to be the only way of getting a satisfactory account of a *statical* principle. In fact, whenever we come to examine carefully into the nature of forces from a consideration of their effects, amongst those effects we invariably recur to *motion* and its various degrees of intensity, as their most natural and obvious exponent. It is altogether fallacious to consider the properties of equilibrium and motion as different in the *nature of things*, however convenient to treat of them separately. The general problem is this: A given mass is acted upon by various forces at different points of the mass—find the effect. Of this effect, equilibrium is a particular case, viz., when the forces happen to be related to one another in a certain particular manner; but the *general* effect is obviously motion. Every attentive reader on these subjects must have observed, that in that portion of the science to which the name of dynamics is given, the effect of each force and its influence on the others is capable of being traced, and a more satisfactory account given of the part performed by each, than in the "statical" portion. That bone of contention, the "principle of virtual velocities," is just in the condition of the bat in the fable—being on the confines of two territories usually considered quite distinct — it participates in the nature of two species, and is alternately rejected by both—it is neither beast nor bird — neither statical nor dynamical. As to its signification, the truth, of which it is the enunciation, under a form adapted to calculation, is simply this:—If the force acting on a mass, or system of rigid bodies, be such as to destroy each other's effects *statically*, they will also *dynamically*; that is, if the system be any how in motion, the whole mass moved in any given direction, has its counterpart in an equal mass moved as much in the opposite direction, so that the *mean* or average effect, as measured by the quantity of matter put into motion in any given direction, is nothing; or, if once the system be at rest, the

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continual *tendency* to an average motion in one direction is counteracted by an equal *tendency* in the opposite direction. Robison in his *Mech. Philosophy* (vol. i., page 157) has stated this principle wrongly: his words are, "In the same way the celebrated mathematician De la Grange observed, that a system of bodies acting on each other in any way is in equilibrio, if there be impressed on its parts, forces in the inverse proportion of the velocities which each body takes in consequence of their action or connexion, &c." Now this is not true, except in the particular case where only *two* forces act. For if we take three for instance, P, Q, R, and call the virtual velocities of these dp, dq, dr, respectively, the formula is,

$$Pdp \pm Qdq \pm Rdr = 0.$$

Now if each force were inversely proportional to its own virtual velocity, we should have, then,

$$\frac{P}{Q} = \frac{dq}{dp} \text{ and } \frac{P}{R} = \frac{dr}{dp},$$

and by substitution,

$$dp \pm dp \pm dp = 0,$$

which is impossible, whatever sign be taken for dq and dr. If, however, there be only two forces, so that

$$Pdp \pm Qdq = 0,$$

then $$\frac{P}{Q} = \frac{dq}{dp},$$

and Robison's enunciation is correct.

(*To be continued.*)

THE "COLLEGE OF PRECEPTORS."*

Under this title—a title which itself bespeaks the most silly affectation—an enrolment of from six to eight hundred members of the "scholastic profession" has been effected within less than a twelvemonth. The college numbers amongst its patrons nearly all the public men, who, as members of parliament and otherwise, have busied themselves with the education question as a political and moral movement: and though their especial and principal "patron" is, at present, the President of the Royal Society, the founders of the college aspire to the honour of writing the name of the Prince Consort at the head of their list. This, to use the current cant of the day, is "a great fact;" and it deserves, on many accounts, the most serious attention. The movement appears to us to be pregnant with very momentous consequences, if successfully carried out; and we feel it to be our duty to dwell with commensurate detail upon its origin, proceedings, and probable tendency.

We ourselves have laboured too long, too consistently, and too earnestly in the cause of general improvement, to be suspected of sinister purposes, if we venture to express our decided antipathy to the course which this society is pursuing —if we denounce the scheme as selfish in its origin, preposterous in its aims, prejudicial to the spread of sound education, and an unparalleled system of tyranny and extortion with regard to "the profession." We shall fortify ourselves by giving a few of the facts from which we have deduced our conclusions, and leave to our readers to say whether they justify our inferences—and if they do not, why all that can be said is that they do not justify our views.

As an abstract principle—as a practical duty, too—we not only admit, but we contend, that some unquestionable test of the competence of a teacher, together with an authoritative diploma expressive of that competence, is an *essential condition* for the real and permanent improvement of our educational system. The parent would thereby obtain security for the skill of the teacher to whose care he committed his children's mental and moral training; whilst the schoolmaster himself, from having a *defined status*, would obtain a degree of respectability, and an independence of parental caprice, which he cannot claim or exercise under the existing scholastic system. At present, the respectability of the schoolmaster is altogether adventitious, if not, indeed, altogether fictitious; and it depends much more upon other qualities, and the exercise of other functions, than those upon which his professional responsibility should be based. In fact, a successful schoolmaster is more of a trader than a member of a learned profession; we mean, of course, the class of schoolmasters who have chiefly enlisted under the Brighton banner. However, that a scheme, the chief, if not the only tendency of which is to give publicity to the

* "Calendar of the College of Preceptors," 112 pp. 8vo. Longman and Co.

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names of a few third-rate but bustling schoolmasters (men, perhaps, better fitted for organizing speculative commercial companies than for organizing the details of a school)—that such a scheme is likely to improve the race of schoolmasters, or to facilitate the diffusion of sound learning, we are little disposed to believe. Yet such a condition of the teacher as that for which we contend, appears to be the imperative duty of the legislature to create; and we trust the time is not very distant when our legislators and the government will feel it their interest to organize such a one upon a liberal scale, and upon strictly impartial principles. With many of the common-place truisms put forth by the promoters of this college, as "claptrap," we of course concur; but as put forth by them, it is only subsidiary to a scheme which can never (at least in such hands) effect its professed object; and if we are not greatly in error, which must tend to retard almost indefinitely the amelioration of our educational system. That some change is required is admitted on all hands; but that any attempt *which is not backed by penal enactments* can be effective in weeding quackery and pretension from the "profession" we do not believe. It is precisely the case in the scholastic as in those professions, with which we are ourselves in more immediate contact; that till a diploma granted by a board of examiners constituted by legal enactment, is made the condition of *legal power to practise the profession*, it will always be a degraded profession — seldom adopted by men of high spirit, but composed of members, the great majority of whom are an absolute discredit to the few who are properly qualified for their duties. Why should the schoolmaster, the engineer, and the architect, be less protected in the exercise of their skill than the lawyer, the surgeon, or the priest? Even with all the protection which laws, and highly penal laws too, afford, we hear of "black sheep" of the law,' "quackeries" in medicine, and "simony and sins of many kinds" amongst the sacred order. But what would the state of these "professions" be (so called, *par excellence*, in consequence of the purity which this protection is supposed to ensure amongst their members) if such safeguards did not exist? We have only to look into our common "commercial, mathematical, and classical" schools for an answer; and still nearer home, amongst the persons who write themselves, "C. E.," or "Architect," we see too many disgraceful illustrations of the appropriate answer.

That bubbling, boiling cauldron, "the public mind," has of late years been spiced with an indistinct notion that "education is not quite the thing it should be;" and that amongst the school-master-class there is often more pretension than learning, and more of incompetence than honesty. The "public mind" has not, however settled down into any very distinct views respecting the best mode of correcting the suspected evils: but according to general practice it flew at once from one class of pretenders to another—it repudiated all the claims of one class, and, with the most ludicrous simplicity, magnified voluntarily the pretensions of another class of solicitors for its patronage! Certain vague notions had been artfully diffused in the different "crannies" of the "public mind" that "Cambridge mathematicians" and "Oxford classics" were *of necessity* great men and sound scholars—and that they were the only ones that England produced. As a *necessary* truth we have shown over and over that in respect to "Cambridge mathematicians," this is a preposterous assumption. Were this the proper vehicle for the discussion, we could show that the pretensions of the "Oxford classics" are quite as absurd as those set up for Cambridge—as far at least as to the *necessity* of the Oxford degree implying profound, or even respectable, classical acquirements. In neither university does the "poll-degree" furnish any criterion of learning—even that amount which is necessary for a respectably educated member of social life. Yet this degree dazzles the intellectual eye of the "public mind;" and the meanest attainments are accepted by the multitude as of the highest order, if labelled by the Vice-Chancellor of either university. Mr. John Bull (the bodily impersonation of the "public mind") loves to be "bamboozled" into a belief of his own penetration! The veriest mare's nest, in connexion with literature and science, affords him the most intense and child-like delight; and on this

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crotchet he has been tickled so long, and likes it so well, that he hastily calls out "more! more!!" More he *will* have—more he *must* have. The "College of Preceptors" have therefore begun to tickle his proboscis with straws; and his auricles are energetically excited by the bristles of this new "hedgehog" product of the mare's egg!

Our grammar-schools are, as a general rule, by their charters and endowments, compelled to employ none as masters who are not graduates of Oxford or Cambridge, and mostly in holy orders; and when the emoluments are such as to render the appointments desirable, these appointments are in most cases given to men respectable and sometimes eminent for their classical attainments. Our clergy, too, from their reputation as scholars (especially Oxford men), and from the inferior character of the common schoolmasters of England, have in a great number of cases (the unbeneficed, the curate, and the incumbent of a small living) eked out an existence by taking private pupils, or by establishing boarding and day-schools. Of course, their reputation, with moderate attention to their duties (and sometimes, too, under most culpable neglect of those duties), has secured for them a preference, and gained for them a *prestige* which they will long retain.

The formation of schools on the joint-stock principle, in which it was foolishly anticipated that a superior education could be rendered compatible with the most contemptible remuneration, have almost invariably applied to the universities (chiefly to Cambridge) for their masters. No man of ability, station, or learning, would of course listen for a moment to the insulting conditions that were generally proposed by the managers of these schools; but there is always a number of inferior persons, who have just taken a common degree, or gone out at the margin of the gulf, to whom even appointments like these are a sort of godsend. Every city has its "college" and every town its "proprietary school." Here, in one great mass, boys are "prepared for the universities, the army and navy, the Royal Military and the East India Companies' Colleges, engineering, professional life, and commercial pursuits!" Men who have just taken their bachelor's degree, who have not had time to systematise in their own minds their modicum of acquirement, who have proved by their position on the tripos, or on the poll-paper, how small that modicum is at best, and who have never had an hour's experience in practical tuition — such men boldly undertake all this range of instruction with infinitely more *sang froid* than the most learned and experienced teacher would undertake a single department of it! Neither have these cases formed the varieties of our modern system of scholastic imposture — they were the events of every day; and they are to be witnessed at the present hour as rife as they were twenty years ago.

The result has been such as ordinary prescience would have led sensible men to predict: dissatisfaction with the pay on one side, and dissatisfaction with the "services" so paid for on the other. The mean and ignorant selfishness of the mere trader was rewarded by a system of charlatanism that disgraces our age and country. This system of mutual hard dealing—the "diamond-cut-diamond" system—has produced its appropriate fruits—illiterate and presumptuous tutors, and still more illiterate and presumptuous pupils!

One of the worst effects of the modern system of joint-stock schools, has been to lower the character of teachers in general. Men of ability and acquirement in almost every town where these schools have been established, and who were devoted to education, have been driven out of "the profession" by the insane preference of the public for "B.A.s" and "M.A.s", and have devoted their energies to other, more lucrative, and more reputable modes of life. On the other hand, the swarms of locusts imported by these schools from the universities, after their year or two of tenure (for it seldom happened that a longer period elapsed between the appointment and dismissal), managed to set themselves down as rival schoolmasters. They thus gradually absorbed the entire support of the locality. The original promoters of these schools, too, having had their turn served in the "education" of their hopeful progeny, have ceased to exert that activity for supporting the schools they had planned. So general, indeed, is the apathy towards such institutions now

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become, that it is with the greatest difficulty that a few of them drag on a lingering, dying existence, with no resource, beyond increased rapidity in changing masters; and, in fact, the far greater number are "let" at the rent they will fetch, to some of the many illiterate teachers, who have been called into existence, by the fearful facility which the system has afforded, for glutting the market with schoolmasters of the university manufactories. As to new attempts to establish this class of schools, they are very rare; and we believe the only one of very recent days, is the "Brighton College"—a creation of last year, and which commenced its active career with the present one.

It is to this project that the "College of Preceptors" owes its creation; and we shall proceed to detail its history, objects, and probable tendencies.

(*To be continued.*)

REED'S "COMET," OR LONG RANGE.

Sir,—I send you a sketch of my "Comet," or long range, with some prefatory observations on rockets. Opinions will differ as to its capabilities. Those desirous of testing it, had better get up a subscription for the purpose—for I have done with it. I give it to the world more as a means of saving life, by carrying lines to and from vessels, than as a war weapon. Its destructive capabilities are, however, so immense, as to defy a guess. I conceive half a ton of gunpowder might be projected at one flight from the trenches into a besieged town.

I am, Sir, yours, &c.,
JOHN POWELL REED.*

Description.

The range of a rocket depends upon two things—its velocity, and length of flight. If a composition could be made to be slow of consumption, and at the same time with the explosive power of gunpowder, the range of projectiles would be very great. Its velocity is impeded by weight, and hence the necessity of the cases &c., being as light as possible.

With rockets that have sticks there are serious drawbacks. The stick being made to counterpoise the weight of the rocket, it follows that, from the socket where the stick screws in, the stick must be either heavy or long,—decreasing one way, it must increase in the other. The increase of weight, as has been said, is a drawback to its flight; the increase of length is, if anything, a much more serious drawback. In the first place, the length of a moderately-sized rocket-stick will be from 18 to 24 feet long (see fig. 1); for a small 3 lb. Congreve, it is 5 feet. To fire this in any direction other than dead to windward or dead to leeward, an allowance for the wind acting on the stick and turning it (the rocket) must be made, increasing in proportion with the angle of the wind with the object to be hit, up to 90, and also with the increased violence of the wind. For instance, a rocket fired *across* a gale of wind, would require 45° or 50° allowance; in fact, in such case, the rocket must be next to useless.

It will be seen, therefore, that up to this period serious objections to the use of rockets have existed: they could not be made beyond a moderate size, say 4 or 5 inches diameter, because the cases would require to be thick for strength, and this would require an additional weight and length of stick for counterpoise; and with the two additional weights the flight would be seriously impeded. It has been found that a 24-pounder

* To explain the tone of disappointment in which this letter is expressed, we take the liberty of subjoining a word or two by way of explanation. In saying that he has "done with" his invention, as a warlike instrument, Mr. Reed must not be understood as at all despairing of its utility in that respect, but as alluding simply to the fact of his having done his utmost, without success, to induce the government to give it a trial. We have been favoured with the inspection of a mass of official correspondence on the subject, and, after perusing it, do not wonder that such treatment as Mr. Reed has experienced should have at once annoyed and disgusted him. Mr. Reed is an ex-captain of engineers of the Spanish legion, in which he served with great distinction, and had every claim, therefore, on the score of practical knowledge and experience, to more favourable consideration. At the same time, we are free to own, that after the prodigious stir made about the Warner "long range"—after the large sums thrown away upon it, and after its most ludicrous failure, we are not at all surprised that the government should fight shy for a time of everything of the "long range" genus. Warner's prime agent now turns out to have been a balloon! It was to be despatched in the direction of the object to be hit, and, *providing the wind blew perfectly straight in that direction*, it was thought to be quite certain that it would attain a position overhead of the devoted object, upon which it might pour down shot and shell at its leisure, and *ad libitum!!!* A greater piece of humbug than this there has not been in modern times. ED. M. M.

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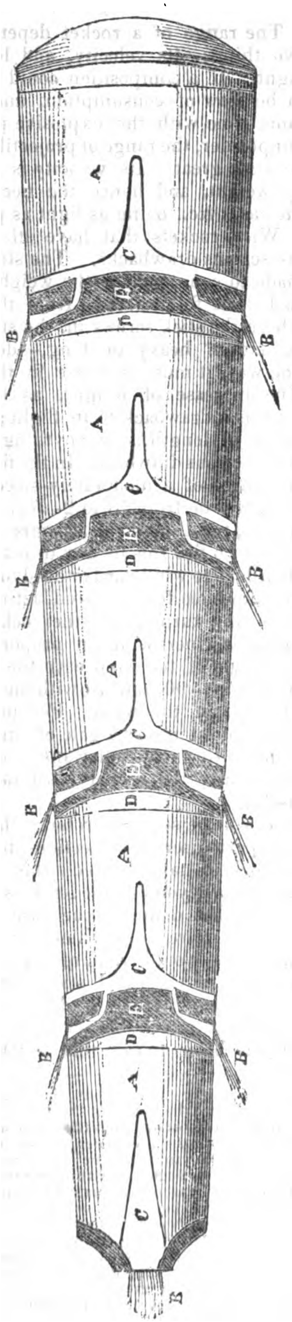

Fig. 3.

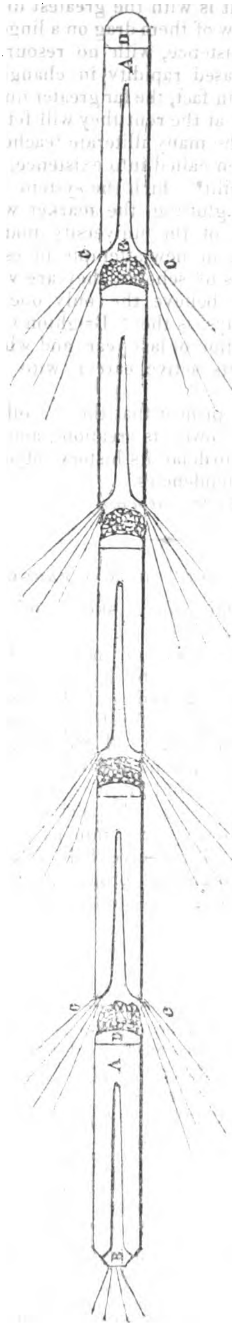

Fig. 2.

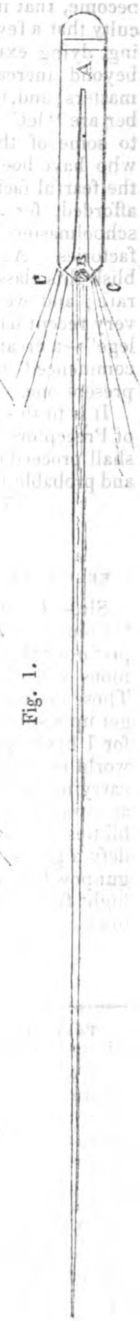

Fig. 1.

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Congreve rocket is the largest size for utility.

Now it will be evident, that if this incumbrance of a stick could be done away with, and the weight lessened, and the flight free from the effect of the wind, a great advance must be made towards doing away with the use of artillery in distant campaigns. Moreover, if at the same time, explosive power could be given to the missile, so as to supersede the common rocket and guns, of such magnitude that a line-of-battle ship might be destroyed with one—it would be next to infatuation to lumber ships' decks any longer with the enormous dead weight of metal with which they are now fitted. I will take, for instance, one vessel in the royal navy, the *Terrible*: she has 16 guns; the gross weight of them, without shot, shell, ammunition, and fitting, amounts to 68 tons, 16 cwt.

The "Comet" (fig. 2) consists of a series of rockets joined together in the direction of their length, offering the resistance of one only, though each rocket forms a separate chamber for combustion. It has a rotary motion given to it from angular bores or vents, through which the gas escapes; each joint is a strong screw; and the whole are fired simultaneously by a quick match along the length, with a leader into each vent or joint. A A is the composition of the rocket, or burning material; B is the hollow spindle or sole; C C are the vents; D D D D, places where explosive compounds may be lodged.

The advantages of the "Comet" are, its correctness of aim independent of wind; going across a gale, without deviating from the correct line. A Congreve rocket, fired across a gale of wind, would turn up, right head to wind, and not unfrequently turn round and come back on the parties using it—a circumstance which can never happen with the "Comet."

It is supposed that by thus uniting the projecting power of many rockets with the resistance of one only; that with slower burning compositions, and shorter lengths, and larger diameters than can be used for rockets as at present made—an increased power and a longer time for burning will be obtained, and, as the result of all, a longer range.

JOHN POWELL REED.

London, April 11, 1847.

Extract from a Letter subsequently received from Mr. Reed, dated April 24.

"I send you another sketch. It is an improvement upon the first 'Comet' I think. I have not tried experiments with this form. With the first I have, and they promise ultimate success. One great advantage of No. 2 form is, that it enables me to get a direct fire, which was a difficulty in No. 1, and also a drawback. Pray excuse this trouble, but the 'long range' has been controverted or contradicted so often, it is but justice to those who profess to be able to do it, that the scientific world should know on what ground they make the assertion.

"Fig. 3 represents the No. 2 'Comet.' A is the composition. B is the vent, for escape of ignited gas. C is the sole or spindle-socket, giving a surface for ignition, which increases as the composition burns. The latter is made of a stronger nature in the first instance to give the rocket a start, and compensate for loss of surface. D is a wadding of clay over the composition. E the screw-joints.

"It will be seen that the diameters decrease towards the tail. The instrument is made upon the principle that the increased igniting surface will compensate for the loss of the assistance of the smaller diameters, as they burn out; the impetus has been given, and the larger surfaces will supply a sufficiency of gas to keep up the projectile's velocity. Moreover the shortness of each joint, or length of composition, supersedes the necessity of increased quantity of metal in the cases; the form is the most approved for passing through earth or water,* consequently for air. It has a slight rotary motion turning once in 40 or 50 times its length."

EFFECT OF WINDS ON THE BAROMETER.

Sir,—In the article on Meteorology, by Sir John Leslie, in the *Encyclopædia Britannica,* that eminent philosopher has accounted for the falling of the barometer during high winds, by taking into consideration, the centrifugal force exerted by the air as it sweeps over the surface of the globe. This centrifugal force opposes the force of gravity, hence

* Sailors towing a topmast always tow it heel, or thick part foremost.

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the air becomes specifically lighter as it rushes along, and the barometer falls when under the influence of such a current. That this theory is correct, can hardly be doubted, but, delivered as it is in the article referred to above, it does not explain why a north-easterly gale should have the effect, not only of failing to depress the barometer, but of actually making it rise in some degree. Leslie, indeed, endeavoured to account for this phenomenon on the supposition that the north-easterly winds have a course too short for the centrifugal force to exert much effect. But near the close of his article on Meteorology, he lays down a principle which, I think, might be made to yield a much better explanation of this curious fact. At page 747 he says, that "a wind blowing directly from the arctic pole, and impregnated with intense cold, must, *in consequence of the rotation of the globe*, *appear* to arrive from some point to the north of east." Now, it is plain, that such a wind can have *no centrifugal force*, and, accordingly, no tendency to depress the barometrical column —in fact, the coldness and density of that arctic air may cause the mercury to rise. We may say of the aërial currents, as of the motions of the heavenly bodies, that some are *real*, and some are *apparent*. It is only the real winds that depress the barometer, the apparent winds not having any centrifugal force. Perhaps this theory may account for the quiescent state of the barometer in tropical climates.

From Captain Bazil Hall we learn, that, generally speaking, the winds in the tropics are polar currents, which, having a less velocity in longitude than the equatorial regions, are those left behind by the earth in its daily rotation, and appear as easterly winds; while, on the other hand, the winds in the northern region are equatorial currents, which, having a greater velocity in longitude than the temperate and frigid zones, outstrip those regions in the rotation of the earth, and appear as westerly winds. It therefore appears that the former are *apparent* winds, and the latter are *real*. As the winds in the southern regions do not exert any centrifugal force, while those in the northern regions do, it follows that this force cannot disturb the barometer in the vicinity of the equator; while in the vicinity of the pole the barometer must be powerfully affected by the centrifugal force of the wind. The temperate zone being subject both to real and apparent winds, must have very fluctuating barometers, and the same holds true to some distance within the arctic circle, explaining Dr. Halley's assertion, that the more northerly places have greater alterations of the barometer than the more southerly. At Barbadoes, the wind is almost always E.N.E., and at St. Helena E.S.E., and the barometer in those places has scarcely any variations, a fact which supports the doctrine I have lain down.

The above is merely a broad outline, a general plan, and it must be expected that in the details there are certain modifications. Local winds, whirlwinds, and tornadoes, may act as exceptions to the general rule; but to embrace all points would be to write a volume. Perhaps I have been anticipated in the above remarks; but as I am not aware that such is the case, I venture, Sir, to put them before you, subscribing myself,

Yours respectfully,

J. PITTER.

Hastings, May 3, 1847.

THE "IMPROVED SPRING LOCK."

Sir,—I find that in the description of a new spring lock, which I sent you last week, I omitted a material part. I ought to have added, that in one of the tumblers there is to be a pin fixed, which goes through holes in all the other tumblers; these holes are to be so large as to allow of some play of the pin in them, but so small that none of the tumblers can be raised high enough to draw back the bolt without the other tumblers (or some of them) being also raised so as to stop the bolt, unless they are all raised at once by the key to the proper height.

Without this addition, as, no doubt, some of your readers have observed, there is nothing to prevent the bolt from being drawn back by an instrument which will raise any one of the tumblers without touching the others.

I am, Sir, yours, &c.,

E. B. DENISON.

Lincoln's Inn, May 3, 1847.

MR. BIRAM'S IMPROVED MINER'S SAFETY LAMP.

[Registered under the Act for the Protection of Articles of Utility. Benjamin Biram, of Wentworth, Esq., Inventor and Proprietor.]

The imperfections of the "Davy" lamp are now sufficiently notorious; every year furnishing a lamentable account of

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additional evidence confirmatory of the small dependence to be placed upon it.

Fig. 1.

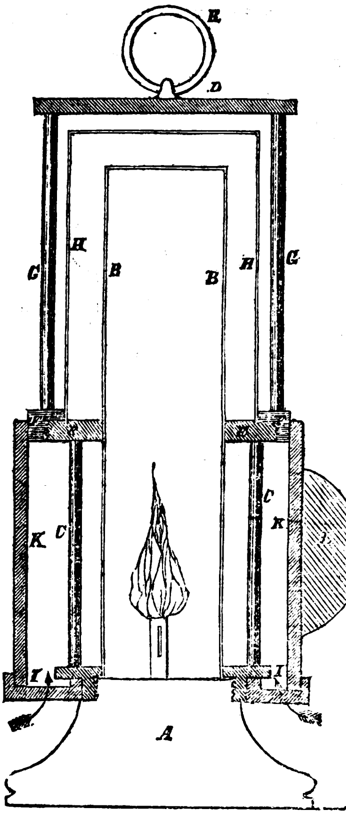
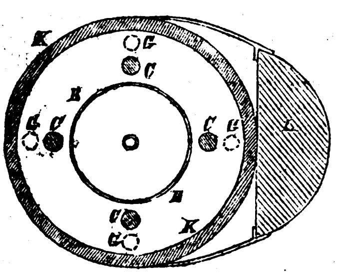


Fig. 2.



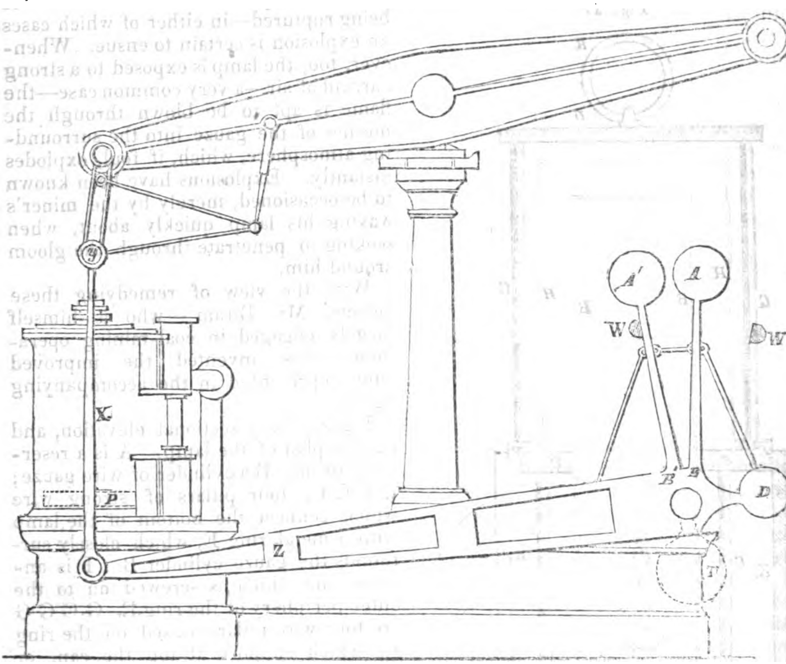
The fouler and more explosive the atmosphere the greater is the risk of the gauze becoming red hot, and inflaming the coal dust which accumulates upon it, or of some of the wires being ruptured—in either of which cases an explosion is certain to ensue. Whenever, too, the lamp is exposed to a strong current of air—a very common case—the flame is apt to be blown through the meshes of the gauze into the surrounding atmosphere, which, if foul, explodes instantly. Explosions have been known to be occasioned, merely by the miner's waving his lamp quickly about, when seeking to penetrate through the gloom around him.

With the view of remedying these defects, Mr. Biram—who is himself largely engaged in coal-mining operations—has invented the improved lamp represented in the accompanying figures:

Figure 1 is a sectional elevation, and fig. 2 a plan of the lamp. A is a reservoir for oil; B a cylinder of wire gauze; C C C C, four pillars of strong wire which connect the bottom of the lamp with a metal ring E, which closely surrounds the gauze cylinder B. F is another ring which is screwed on to the outer periphery of the ring E. G G G G are four wire pillars raised on the ring F, which support at top the cap, or plate D, to which a ring R is attached for carrying the lamp. H is a second gauze cylinder which surrounds the upper half of the inner cylinder B, and is made fast to the top of the ring E by means of a flange at bottom, which is overlapped by a flange projecting from the inside of the ring F; I I is a gallery which is attached to the bottom part of the lamp, and serves as a support to a cylinder K, which may be of strong glass, made large enough to be slipped freely over the ring F, or it may be of tin, or copper tinned, and polished inside, and provided with a lens L, attached to one side of the cylinder K.

The second gauze cylinder H is intended not only to protect the inner cylinder B from damage, but to intercept the coal dust and prevent it from falling on B, which, by being kept clean, is rendered less liable to become red hot. The cylinder K, again, is designed to protect the flame in strong currents, while the lens L serves to concentrate the light on any particular spot. The cylinder and lens may be taken off when their assistance is not required.

FORDER'S PATENT WEIGHTED LEVER—APPLICATION TO STEAM-ENGINES.



In our journal of the 14th Nov. last we gave a full description of this remarkable invention, and showed its application to the pumping of water. The *Railway Register* has done us the honour to transfer our article to its pages (with due acknowledgment), and has added the following exemplification of its applicability to steam-engines worked expansively:

"A B and A′ B′ are the two weighted levers placed about 15° apart, and P the piston, which is shown in the figure at the bottom of the cylinder. One of the weighted levers, A B, is represented over the axis, and the other, A′ B′, hanging over the beam, and exerting its weight in pulling down the piston. W W are stops to limit the action to the range of the piston stroke. Z the beam, with a knife edge resting on a seat, fixed in the frame F. X one of the side rods, connecting the working end of the weighted lever beam, with the piston-rod at *y*. T′ is a counterpoise to the weighted lever shafts, and the sides' support, and D is a counterpoise to the beam. Now, after the piston has performed half its stroke (say the down stroke), the energy of the steam then decreases, and so the weighted lever A′ B′ increases in power or leverage in the same time and proportion, and thereby aids the piston. When again the steam is first let under the piston in its upward stroke, and the steam is in excess of the duty required from it, such excess serves to depress one weighted lever and to raise the other, until they arrive at the middle of the stroke, when they will be in equilibrium; after which, as the steam attenuates, the leverage of the weighted lever, A B becomes greater than that of A′ B′, and exerts its greatest weight or force in aid of the working power.

"Thus the excess of steam-power is transmitted to its reciprocal weighted lever at the first half of the stroke, which the latter returns during the last moiety in aid of the motive power when weakest. It will be observed that there can be no loss in consequence of the retardation of gravity to the rising weighted lever, as that resistance is neutralised by the acceleration of gravity of the other.

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"One advantage to be gained by the use of the weighted lever is, that it stops with the engine; whereby the power stored is ready for use whenever it is required. This is not the case with the fly-wheel, which, to be serviceable, must be driven at a certain velocity; and when the engine is stopped continues its motion until all its power is uselessly expended. The possibility of stopping the engine for any length of time, without losing the accumulated power, is a peculiar feature in the weighted lever, and makes it a valuable auxiliary to expansive engines; because it admits of a sufficient pause being made by the piston at the end of each stroke to enable the whole of the waste steam to escape through the eduction-valve, thereby effecting a greater exhaustion and consequent increase of the useful effect.

"In addition to the advantages before noticed, which will be derived from this invention, may be mentioned those of its applicability to expansive engines already erected, without disturbing the present structure; and its peculiar value, as an auxiliary magazine of power, to such engines, in cases where a fly of sufficient dimensions cannot be erected from want of room or otherwise."

MR. LEAHY'S IMPROVEMENTS IN STEAM ENGINES.

[Patent dated November 5, 1847; Specification enrolled May 5, 1847. Patentee, Matthew Leahy, of Great George-street, Westminster, Civil Engineer.]

The patentee states that his invention has reference to that class of steam engines known as locomotives, and consists of four parts:

Firstly, in the enlargement of the firebox, by placing it between the driving and the running wheels, and extending it, laterally, to any convenient distance outside the rails, whereby a greater amount of heating surface is obtained, and the power of the engine materially increased. In order to counteract any injurious effect which the overhanging weight of the firebox might have on the engine, he surrounds it (the engine) with an "outside frame," in which the bearings of the driving and running wheels are supported.

Secondly, to still further increase the heating surface of the firebox, it is arched out over the hinder running wheels, and is intersected by partitions filled with water; and a "bogie" is attached by a centre-pin or pivot to the locomotive, so constructed and arranged as to turn with facility any curve, and bear a portion of the weight of the engine. The "bogie" is constructed as follows:—Underneath the platform is a circular metallic ring, slightly inclined inwardly on its upper surface, and having radial arms to connect it with the jacket which encircles the centre-pin or pivot. Over this circular metallic ring is another, which serves the purpose of a coupling, and is inclined on its under surface so as to correspond with the former. In the lower circular metallic ring there are conical rollers, supported in suitable bearings. The patentee states, that by this arrangement and construction, the strain upon the centre-pin and friction of the parts will be diminished.

Thirdly, to enable the engineer to ascertain when the bearings of the driving, or other parts of the engine, become heated, he proposes to bore a small chamber in the metal, close to each bearing, which is to be filled with ether, or such other body as will, by its volatilization or change of form, indicate the increase of temperature. A pipe is to be attached to this chamber, and brought into a glass globe, placed near the driver, so that he may easily discover any dangerous increase of temperature. The bearing is proposed to be cooled by means of a pipe leading from the water reservoir to it, through which water is pumped by the engine when required.

Fourthly, as it may be advisable to increase or decrease the space between the fire bars, the patentee superposes a rack, in which they fit (the bars being adjustable), in order that, by "shogging" the rack, the bars shall incline either in one or other direction, and the admission of air be thereby regulated.

RECENT AMERICAN PATENTS.

[From Mr. Keller's Abstracts in the *Franklin Journal.*]

IMPROVEMENTS IN THE WATER-RAM FOR RAISING WATER. *Erastus W. Ellsworth.*

Claim.—"This invention consists in a peculiar manner of working the water-ram (Montgolfier's) in combination with the syphon, by the use of a chamber of rarefied air, for the purpose of causing the escape-water to flow down the longer leg of the syphon in a continuous stream; also, in the use of channels in the packing of the joints, supplied with water from the air-vessel of the ram, for the purpose of excluding completely, and with certainty, the external air from the syphon; also in the fixtures herein described for the setting in motion and regulating the quantity of water consumed by the ram."

IMPROVEMENT IN PRESSING GLASS IN MOULDS. *Joseph Magoun.*

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The bed of the press is so formed and connected with the slide of the follower of the press as to admit of the introduction and removal of any mould, that various moulds may be used in succession. The moulds have a flange at the top, which rests on the bed plate.

A METHOD OF COMBINING CANALS AND RAILROADS. *Samuel S. Walley.*

The patentee proposes to combine the railway and canal for the purpose of transportation, by laying rails on the bottom of the canal, and by the employment of a locomotive engine and of car-boats, which, whilst their wheels are sustained upon the rails, are to be buoyed up by the water, as set forth.

He claims particularly the adapting of the car-boats and the lock chamber to each other, so that when the former are contained within the latter, they shall operate as lock-gates by preventing, or nearly preventing, the passage of water, thereby allowing the lock gates to be opened and the train to pass through the lock with little loss of water, upon the principle and substantially in the manner herein described.

IMPROVEMENT IN THE MACHINE FOR DOUBLE SEAMING TIN WARE. *Daniel Newton.*

Claim—"What I claim as my invention and desire to secure by letters patent, is the turning of a double seam on the bottom of tin and copper ware, by the application of a bevel wheel on a shaft placed at right angles with the shaft on which the vessel revolves, in combination with the guide on which the same rests, in order to insure a perfect rotary motion of the vessel."

The article to be double seamed, is placed on a wheel at the end of a horizontal shaft, and guided and retained on it by a guide standard; and the double seaming is effected by a bevel wheel on a vertical stud pin, the bevel part of the wheel acting in connexion with the edge of the wheel that carries the article to make the seam.

A MACHINE FOR BEATING and CLEANING Wire. John J. Howe.

Claim—"I claim as my invention, the combination herein described, of parts which are designated herein, and marked in the drawings respectively, as follows, viz.: the block or platform, the lifter, and the curb or pins 1 and 2; and I claim said combinations of the block, lifter, and curb, whether in combination with or without the guide."

The platform is a bed with a hole in the centre, and excavations to receive the spindle hub and radial bars of a lifter on which the wire is to be placed. This lifter is carried up gradually by a cam and then permitted to fall, to give the required jar or blow to the wire, which is retained on the lifter by a series of vertical rods projecting from the platform. The lifter may receive a slight rotary motion by a guide.

AN IMPROVEMENT IN THE METHOD OF RAISING SPRING WATER. *Benjamin S. Benton.*

Claim—"What I claim as my invention, is the raising spring water to a higher level than its source by the momentum of a running stream of river or other water in contact therewith, in a double ram, constructed as aforesaid, or other ram constructed and combined substantially in the manner set forth, by which analogous results are produced—the two rams being united by an additional pipe, in which the spring and river water come in contact, as above set forth.

"I also claim the combinations and arrangements of the lever, bucket, and valve, with reservoir, as described, for keeping up the action of the machine. I likewise claim the arrangement of the spring for insuring the opening of the valve, as described."

There is a vessel, containing the water to be employed in raising the spring water, that communicates with one ram, and this, by another pipe, communicates with a second ram, which, in turn, communicates by a pipe, with the reservoir of spring water to be raised. The first ram has a waste pipe and puppet valve, and the second has an air vessel with a valve interposed between the main chamber and the air vessel, and another valve at the end of the pipe that leads from the fresh water reservoir into the chamber of the ram. When the puppet valve of the first ram is opened by a lever, the water from the two reservoirs rushes to and out of the waste pipe, until the momentum is such as to close the valve, and then the propelling water from a greater head than the spring water causes it to return into the secoud ram, and into the air vessel thereof; at the same time closing the valve in the pipe leading to the fresh water reservoir; this impulse forces the fresh water up through a small pipe leading from the air vessel, to the required height. The return pulsation, &c., takes place as in the common water ram.

For the purpose of keeping the river water at the required height, in the reservoir, and to stop the flow when not high enough, there is a spout in the reservoir which discharges water into a bucket on one end of a lever, the other being provided with a valve which closes the pipe that leads to the first ram. The bucket has a small hole in the bottom for the discharge of water, so that when the water in the reservoir is below the required level the water runs out of the bucket, and when empty, the valve end of the lever preponderates, to close the

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valve and stop the machine, but when the water rises sufficiently to flow over into the bucket faster than it can run out, then the valve is opened, and the operation goes on.

IMPROVEMENT IN CLOCKS OR TIME-PIECES. *Thomas A. Davis.*

This is for making use of the weight of a clock and case as a substitute for the weights heretofore employed to carry the movement and striking part, which is effected by carrying the cords from the two driving drums up through the upper part of the case, and uniting and hanging them over a loose pulley; so that the weight of the clock is hung to the cords, which, passing over a loose pulley, will always keep it balanced, irrespective of the motion of the two movements of the clock.

Claim—"What I claim as my invention, is suspending the case and parts of a clock or time-piece, as above described, in such a way as that the weight of the same will cause the working parts to go in the usual way, thereby saving the expense of the ordinary weight and springs as the motive power. I also claim the introduction of the pulley, as herein described, to regulate the weight between the time and strike sides."

VEGETABLE COMPOSITION to be moulded into various articles, such as handles, heads, &c. *Charles Branwhite.*

The following is an extract from the specification:—

"Take half a pound of starch and dilute it in one pint of cold water, then put one quart of water in a gallon open vessel, and let it boil,—then pour the diluted starch into the vessel, and when it again boils add three pounds of rye flour, and stir it well while on the fire, until the whole is well mixed together. When this mixture is cold, take it out of the vessel and place it on a flat surface. Now take finely sifted dry mahogany saw-dust, (or, finely sifted wood ashes, or whiting may be used,) and stiffen the dough to the consistency of good putty, by working the whole together well with the hands. The composition is now ready for use."

Claim—"What I claim as my invention, is the before described vegetable composition, for the purpose of making moulds, heads, and handles of every description, especially in the making of fringe and tassel moulds, parasol and umbrella handles or heads."

AN IMPROVEMENT IN COLOURING DAGUERREOTYPE PLATES. *John B. Isenring, assigned to Frederick Langenheim.*

The patentee says,—"The nature of my invention consists in colouring a daguerreotype picture by agitating a quantity of highly pulverized mineral, or other suitable colour in a box, and then placing in said box the plate to be coloured, having only such parts exposed as are to receive the colour, the rest being covered by a stencil or other similar device, where it remains until the colour settles upon it in sufficient quantities."

Claim—"What I claim as my invention, is the process of depositing the colour thereon, substantially as herein described, by causing the finely pulverized particles of colour to float in the air over where the plate is placed, which, as they settle, are deposited on the uncovered portions of the plate, in the manner and for the purpose herein described.

"I also claim, in combination therewith, covering the picture with a stencil, as set forth, constructed in the manner and for the purpose described."

IMPROVEMENT IN COLOURING DAGUERREOTYPE PLATES, BY FIXING THE COLOURS THEREON. *Frederick Langenheim.*

The patentee says,—"In the invention of Isenring, for colouring plates, for which letters patent have been obtained, a difficulty arose in making the colours adhere, and it was found in practice that after a little handling, the colour came off, and the picture was thus defaced. To remedy that defect is the object of my improvement.

"Either before the plate receives the colour, or at the same time, I cause an impalpable powder of gum damarum, or other suitable resinous gum, to cover the parts to be coloured, in the manner described in the patent granted to me as the assignee of Isenring, viz.: by placing the plate in a close vessel, face up, with those parts covered that are not to be coloured, and then filling the atmosphere contained in said vessel with the powder of gums above named, and allowing a sufficient quantity to settle, for the purpose intended; after the colour is laid on the plates I submit it to a sufficient degree of heat to fuse the gum, which causes the colour to adhere."

Claim—"Having thus fully described my improvement, what I claim therein as new, is fixing the colours on the plates by means of gum, applied substantially in the manner and for the purpose set forth."

THE GUN-COTTON—MORE REMARKABLE EXPERIMENTS.

We have again to express our thanks to Messrs. Hall and Son for the communication of the following interesting documents:

Messrs John Hall & Son.

Gentlemen,—I beg to enclose you my report on blasting with the patent gun-cotton at the Holyhead Mountain, Anglesey, the Holland Slate Quarry, Festiniog, Merionethshire, and at the Honourable Colonel Pennant's slate quarries, Penrhyn, near Bangor, Carnarvonshire.

The experiments at Holyhead were made in the presence of Captains Vidal, Collinson, and Shepherd, Commissioners from

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the Admiralty, Mr. Beardmore, Mr. Dobson, Mr. Lister, and Mr. Clifford, Engineers, and several gentlemen interested in the matter.

The rock upon which these experiments were made is exceedingly hard, of a metamorphic character, mica and chlorite slate with quartz.

The results gave the most convincing proofs of the vast superiority of the patent gun-cotton over gunpowder, which was acknowledged by all the gentlemen present.

The gunpowder used in these experiments was *the best Ordnance gunpowder.*

The next series of experiments were made at the Holland Quarry, Festiniog, Merionethshire, in the presence of Mr. S. Holland, Jr., Mr. H. Stock, of Port Madoc, Mr. Chas. Spooner, Port Madoc, Mr. R. Jarrett, Festiniog, Mr. R. Lloyd, Festiniog, Mr. Searle, of Carmarthen, Mr. Chisel, of the Welsh Slate Company, Mr. Owen Pritchard, of Messrs. Matthews and Sons, Mr. Owen Jones, of Messrs. Shelton and Greaves, Mr. Hughes, of Messrs. Casson and Co., Mr. Selwyn, Mr. Hill, and other gentlemen.

The first of the experiments tried in this quarry were made upon an extremely hard calcareous stone, the others upon the slate. The admirable manner in which the slate was removed from its bed by the patent gun-cotton elicited the most general satisfaction, and gave incontestible proof of its suitability in blasting slate, being far superior to gunpowder; the pieces removed by the cotton were large valuable masses.

The last experiments made were in the Slate-quarries at Penrhyns; there were present at these Mr. Wyatt, Mr. Francis, Dr. Roberts, and others.

The wonderful effect produced by the cotton was, you will find by reference to the tabular form, more astounding than any hitherto tried, the huge mass of *sixty tons weight* was gently pushed from its firmly-bound bed by the explosion of only *eight ounces of cotton;* no splintering of the slate took place, which greatly astonished the workmen, many of whom expressed that the danger was far less by its use than gunpowder.

The gentlemen present acknowledge the superiority of gun-cotton over gunpowder to be in ordinary slate work in the proportion of six or seven to one, and in hard rock, to be four and five to one.

Some other experiments were tried by me at Tridd Issa Quarry, about two-thirds up the Snowden Mountain, with similar good success.

I am, Gentlemen, your obedient servant,

Bangor, May 5, 1847. JOHN F. WHEELER.

EXPERIMENTS MADE IN BLASTING WITH GUN-COTTON IN THE SLATE QUARRIES OF THE HON COL. PENNANT, AT PENHRYN, NEAR BANGOR, CAERNARVONSHIRE.

No. of Experiments.	Depth of Hole.	Diameter of Hole.	Quantity of Gun-cotton used.		Quantity of Slate Removed.		Quantity of Gunpowder that would be required to do the same work.
	ft. in.	in.	oz.		tons.		oz.
1	4 2	1½	8	tube	30	In red slate, commonly called by the men "Granite," owing to its great hardness.	40
2	6 5	1⅜	8	tube	60	Hole driven in horizontally; the whole mass gently forced from its bed, just as required by the quarymen.	48
3	8 0	1	8	loose	60	Hole in a similar position, and the result equally good.	48
4	4 0	1¼	3	loose	3	This "shot" being in a very fast place, ought to have had one ounce of cotton.	24

The results of the above experiments were considered admirable by every one present,—producing just the effect so much desired in slate quarrrying.

Bangor, May 5th, 1847. JOHN F. WHEELER.

[We shall give the two other letters next week. ED. M. M.]

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CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 432.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the inrolment of the specification.]

Robert Ransome, of Norwich, iron-founder: of a new invented method of making and casting of iron and other metal plates for the better and more secure covering of houses and other buildings. Cl. R., 24 Geo. 3, p. 7, No. 10. Oct. 25, 24 Geo. 3, 1783; Feb. 9, 1784.

Benjamin Wiseman, the younger, of Diss, (Norfolk,) merchant: of new invented sails for windmills with horizontal leaves, which works or moves with the wind from any quarter, without wanting the help or assistance of any person, as formerly required by the common windmills. Cl. R., 24 Geo. 3, p. 7, No. 3. Nov. 15, 24 Geo. 3; March 5, 24 Geo. 3, 1784.

Joseph Cartledge, of Blackley, (York,) doctor of physic: of a new method of glazing earthenware. [With various kinds of earths instead of salt, lead, and tin.] Cl. R., 24 Geo. 3, p. 8, No. 5. Feb. 5, 24 Geo. 3; May 21, 1784.

James Watt, of Birmingham, engineer: of certain new improvements upon fire and steam engines, and upon machines worked or moved by the same. Firstly, Making the steam vessel so as to be capable of turning round on pivots or on an axis, either in a vertical or horizontal direction, and in employing the elastic power of the steam to press upon the surface of any dense fluid or liquid contained in the steam vessel, and to force it to pass out at a hole or holes made in the circumference or external part of the steam-vessel, in such manner that the fluid or liquid shall issue out in a line forming a tangent to the circle described by the rotation of that part of the steam-vessel where the hole is situated, or at least in a line approaching to such a tangent, which fluid or liquid by its action on the fluid or liquid in which the steam-vessel is immersed causes the engine to turn round, &c. Secondly, methods of directing the piston-rods, the Pump-rods, and other parts of these engines, so as to move in perpendicular or other straight or right lines, without using the great chains and arches commonly fixed to the working beams of the engines for that purpose, and so as to enable the engine to act on the working beams, or great levers, both by pushing and by drawing, or both, in the ascent and descent of their pistons. Thirdly, The application of steam or fire engines to work pumps or other alternating machinery. Fourthly, Methods of applying the power of steam-engines to move mills for rolling and slitting iron and otherm etals, or to move other mills which have many wheels, which are required to turn round in concert, so that the same steam-engine shall directly, by means of a double working beam, or by means of a strong piece of wood, or other material, fixed across one end of the working beam, and by means of two separate rods connecting the said working beam, or cross beam, with proper machinery for producing rotative motions, give motion to two primary wheels fixed either on the same or separate axes, whether acting in concert or applied to different uses: and in connecting together by means of a secondary axis, carrying two or more wheels, different primary motions produced by the same engine, or by two or more different engines, which methods are particularly applicable to the connecting together the motions of the rollers and slitters, or of different pairs of rollers in mills, for rolling and slitting metals, which are worked by steam-engines. Fifthly, The application of steam-engines to the moving of heavy hammers, or stampers for forging or stamping iron, copper, and other metals, or matters, without the intervention of rotative motions or wheels, by fixing the hammer or stamper, to be so worked, either directly to the piston, or piston-rod, of the engine, or upon, or to the working beam of the engine; or by fixing the hammer or stamper upon a secondary lever or helve, and connecting the said lever or helve by means of a strap, or of a strong rod, to or with the working beam of the engine, or to or with its piston or piston-rod. Sixthly, Making the regulating valves which admit the steam into the cylinders of steam-engines, or which suffer it to go out of them, in such a manner, that they are pushed open by the action of the steam upon them, and are kept shut by certain catches or detents which are unlocked at proper times, either by hand or by the engine itself. Seventhly, Improvements upon steam-engines which are applied to give motion to wheel-carriages, for removing persons or goods or other matters from place to place, and in which cases the engines themselves must be portable.

LIST OF ENGLISH PATENTS GRANTED FROM MAY 4 TO MAY 6, 1847.

John Elce, of Manchester, machine-maker, and Richard Bleasdale, of Rochdale, mechanic, for certain improvements in machinery for preparing and spinning cotton, wool, and other fibrous substances. May 4; six months.

William Newton, of 66, Chancery-lane, civil engineer, for improvements in machinery for letter-press printing. (Being a communication.) May 4 six months.

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Joseph Taylor, of Tipton, Stafford, engineer, for a certain improvement or certain improvements in the construction and manufacture of wheels for railway and other carriages. May 4th; six months.

Gardner Stow, of King-street, Cheapside, gentleman, for improvements in the construction of steam vessels, and in apparatus for propelling ships and other vessels. (Being a communication.) May 4; six months.

William Henwood, of Portsea, naval architect, for improvements in propelling vessels and in steering vessels. May 4; six months

Lemuel Wellman Wright, of Chalford, Gloucester, engineer, for certain improvements in machinery or apparatus for sweeping or cleansing chimneys, flues, and other similar purposes. May 4; six months.

Fennell Allman, of No. 18, Charles-street, St. James's-square, Middlesex, consulting engineer, for an improved mode of making, forming, or shaping candles. May 4; six months.

Conrad Haverkam Greenhow, of North Shields, gent., for improvements in the construction of ships or vessels, and in propelling ships and vessels. May 4; six months.

Moses Poole, gentleman, for improvements in apparatus for connecting and disconnecting railway carriages. (Being a communication.) May 6; six months.

Harbert Spencer, of Lloyd-street, Clerkenwell, for certain improvements in machinery for planing and sawing wood, parts of which improvements are applicable to machinery for cutting certain other substances. May 6; six months.

Charles Fox, of Trafalgar-square, Charing Cross, engineer, and John Coope Haddan, of Upper Woburn-place, civil engineer, for improvements in railway chairs and switches, in trenails or fastenings, and in machinery for preparing railway sleepers. May 6; six months.

John Horsley, of Ryde, Isle of Wight, for improvements in preserving animal and vegetable substances. May 6; six months.

Johann Gottlob Seyrig, of New Lenton, Nottingham, engineer, for certain improvements in propelling on land and on water. May 6; six months.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
May 1	1048	Webb and Skinner	Union-street, Southwark	Fastening for attaching fly-wheels to mills.
,,	1049	John Nelson	Highfield, Sheffield	Parturition forceps.
,,	1050	J. Blisset	High Holborn	Breach-plate, or sight-piece of an air-gun stick.
3	1051	Alexander Williams	Seething-lane	Corking machine.
,,	1052	Charlton Brothers	Lionel-street, Birmingham	Castor with screwed pin.
,,	1053	James Allan, sen	Buchanan-street, Glasgow	Archimedian chimney cowl.
,,	1054	Peter James Kirby	Newgate-street, London	Toilet pin-box.
,,	1055	William John Bowden	Ware, Herts, surgeon	Pneumatic inhaler.
6	1056	Barrett, Exall, and Andrews	Reading, Berks	Wrought-iron circular harrow.

Advertisements.

To Railway and Electric Telegraph Companies.

BY HER MAJESTY'S ROYAL LETTERS PATENT.

Reid's Patent-Prepared Wire for Electric Telegraphs, Wire Rope, and Fencing.

THE advantages attending this Wire, are 1. That it may be had of any length. 2. That it is of uniform size, and, when annealed, is of one uniform degree of softness. And, 3. That it is prepared for being galvanized by a process wholly free from injury. Hitherto it has been the practice in cleaning wire, to prepare it for the galvanizing process, to immerse it in sulphuric or nitric acid, by means of which the wire has been much injured in structure from the acid not acting equally on all parts alike. By the new process this evil is entirely obviated, and the zinc coating is found to be more perfect.

For further particulars apply to the Patentee, at 25, University street, London, where specimens may be seen, and all orders will receive immediate attention. CONTRACTS entered into and executed with promptitude.

Profitable Investment.

AN Eligible Opportunity offers to any Gentleman, having money at command, to join in taking out a Patent for an Engine for obtaining Motive Power applicable to all kinds of Machinery. This Invention does not require the aid of heat, and is consequently cheaper than steam power, yet equally useful. The expense of keeping the engine in motion, is less than ⅛th of that required for the generation of steam, it is therefore considered the most valuable invention of the present time. Any person advancing the requisite capital will be entitled to half the emoluments arising from the Invention.

For further particulars apply to J. C. Robertson, Esq, 166, Fleet-street, London.

Patent Carriages.

MESSRS. WHITEHURST and Co. have secured a license from Mr. Thompson, (the Patentee of the "AERIAL WHEELS,") to fit them to every description of carriage. These wheels give carriages a gentleness of motion quite unattainable by any kind of springs whatever. They entirely prevent the carriage making any noise; they prevent all jarring and jolting, and the draught is considerably less than common wheels, particularly on bad roads. Messrs. Whitehurst and Co. have fitted up a brougham with the "Aerial Wheels," in order that gentlemen desirous of trying them may have an opportunity of doing so.—313, Oxford-street, near Hanover-square.

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To Inventors and Patentees.

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Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d*.; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

Ornamental Designs also registered under the 5 and 6 Vic. c. 100.

Offices, 166, Fleet-street, London, and 51, Boulevart St. Martin, Paris.

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs. T. Burnell and Co., 1, Great Winchester-street, London.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

The Gutta Percha Company

INVITE the attention of Engineers, Machinists, Mill Owners, &c., to the PATENT GUTTA PERCHA DRIVING BANDS, which possess the valuable properties of great durability and strength, permanent elasticity, and uniformity of substance and thickness, thus avoiding all the irregularity of motion occasioned by piecings and inequality of thickness of leather straps. They are not affected by fixed Oils, Grease, Acids, Alkalies, Water, &c., and possess extraordinary facilities for being joined, and hug their work in a remarkable manner. Can be had of any width, substance, or length, without joints.

The Company continue to receive most satisfactory Testimonials of the superior quality of these Bands, which can be seen at the Company's Works, Wharf-road, City-road, where all orders will receive immediate attention.

E. GRANVILLE, Manager.

London, March 3, 1847.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1240.] SATURDAY, MAY 15. [Price 3*d.*

Edited by J. C. Robertson, 166, Fleet-street.

FRANKLIN'S PATENT TILE-MAKING MACHINE.

Fig. 2. Fig. 5. Fig. 1.

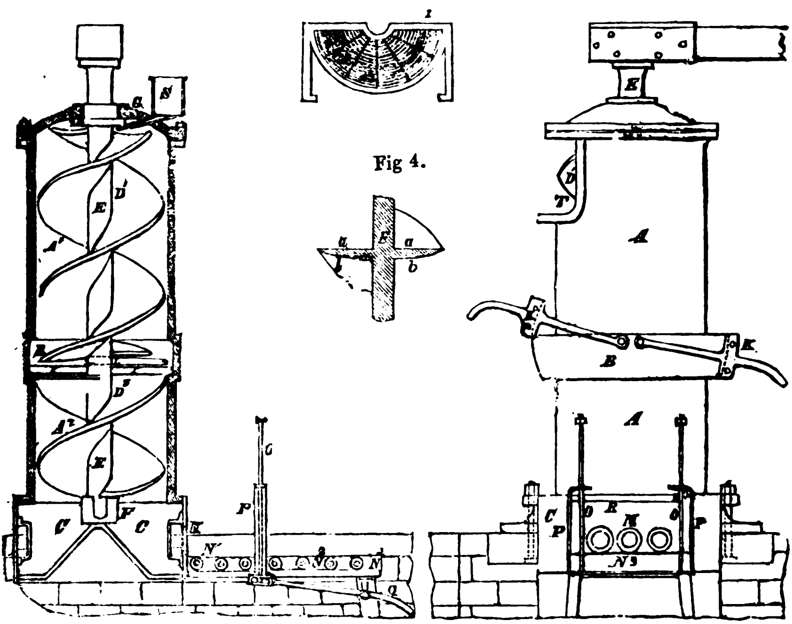
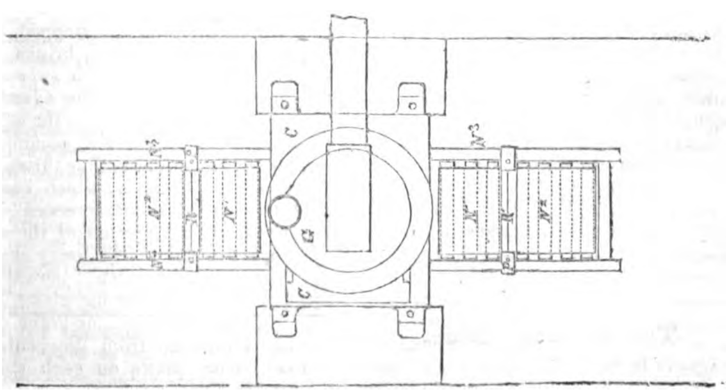


Fig 4.

Fig. 3.



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FRANKLIN'S PATENT TILE-MAKING MACHINE.

[Patent dated Sept. 17. 1846. Patentee, Mr. Henry Franklin, of Marston Morlaine, Beds. Specification enrolled March 17, 1847.]

More than one attempt has been made to apply the power of the screw to the manufacture of drain-tiles; but the present is, we believe, the first which can boast of decided success. A machine of the kind, we are now about to describe, worked by horse power, is now producing about 10,000 tiles a day.

Fig. 1 is an external elevation, figure 2 a sectional elevation, and figure 3 a plan of the machine. A A is a hollow cylnider, which is divided into two portions A^1 and A^2, by an intermediate rectangular chamber B. C is another rectangular chamber, which constitutes the base of the machine, and by which the whole is secured to the masonry upon which it is set. The chamber C may be cast in one piece along with the base of the cylinder A A, or in a separate piece. D^1 D^2 is a double threaded cast iron screw, the largest diameter of which is nearly equal to that of the internal diameter of the cylinder or case A. The web of the thread of this screw, upon the upper side *a*, is in a perpendicular line with the shaft or axis E, as shown in section in figure 4; but the lower side *b* is curved in an upward direction, so as to give an outward inclination to any plastic body (such as clay) which may be introduced into the cylinder, and expelled from it by the action of the screw. The shaft E is stepped at its lower end into a cross bar F, attached to the top of the chamber C; and at its upper end has its bearing in the cover G, which is put on after the screw has been inserted in its place. H is a collar which receives the lateral thrust of the screw, and prevents it from rising up. Within the rectangular chamber B, which, as before mentioned, separates the cylinder into the two portions A^1 and A^2, the threads of the screw are slotted out or removed towards the centre, leaving only the spindle E at that part, which admits of two screen frames I I being introduced into the chamber B, one from each side through the side doors K K. One of these doors is represented in fig. 1 as being open and the other closed. A plan of one of the screen frames is given separately in fig. 5. L is a curved wiper inserted into the screw shaft immediately over the surface of the screens I I, which serves to clear them from stones, twigs, straw, or any other extraneous substances which may accumulate upon their surfaces. M M are mould or die plates, which are represented as being of the patterns commonly used in the formation of pipes, but may be of any desired form or figure. These plates are attached to the bottom chamber C, one on each side, so that both sides of the machine may be in action at once. N^1 N^2 are endless webs, upon which the moulded materials are received. Each of these webs revolves upon a series of small rollers set in the frame work N^3. O O are cutting frames which slide through holes in the uprights P P, and are raised or depressed by the lever handle Q; the wires R of which frames serve as knives to cut off the moulded clay materials at any desired length. S is a vessel containing water, which is allowed to drop slowly upon the screw threads in order to lessen the friction, and otherwise facilitate the passage of the clay through the machine. The mode of operating with this machine, is as follows: The screw shaft is caused to revolve slowly either by power applied from a steam engine, or by the application of animal power; clay is fed into the machine through the opening T, and the revolution of the screw causes clay gradually to descend in the cylinder A^1 and through the screws I I, by which any stones or other non-plastic matters, which may happen to be mixed with the clay, are intercepted and stopped. Each revolution of the shaft E brings round the curved wiper L, which sweeps into the angular corners of the chamber B whatever is too large to pass through the screens. The rubbish, as it accumulates, is removed from time to time through the doors K K. The clay, which has been thus "pugged" and "screened" is by the action of that portion of the screw, which is situated in the lower chamber A^2, now pressed down, towards and through the mould or die plates M M. The bottom of the base, or lower chamber C, is inclined from the centre towards the die plates on each side, in

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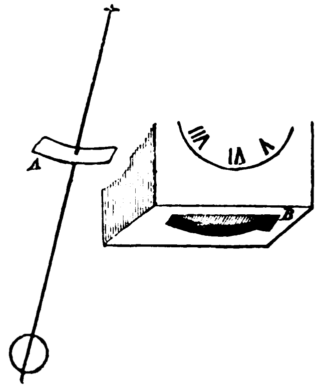
order that the passage of the clay may be facilitated at those parts. The plastic mass, on emerging from the mould or die plates M M, is received upon the endless-webs N^1 and N^2. The cutting of it into lengths suitable for bricks, tiles, pipes, &c., is performed in the manner already described. The finished articles are removed from the endless-web N^2 by hand. Instead of the processes of "pugging" and "screening" and "moulding" being all successively performed by one machine as before described, they may be performed separately, and the machine be divided accordingly into several distinct parts suitably modified. For example: the "pugging" and "screening" might be effected by a machine composed of the upper part alone, the cross-bar F being placed immediately under the screens I I. Or the "moulding" might be effected by a machine composed of the under part alone, the cover of the cylinder A being brought down to where the screens I I are placed in the single machine.

FENNING'S PENDULUM—CAUSE OF LOCOMOTIVES RUNNING OFF THE RAILS.

Sir,—For the purpose of excluding dust from the works of a clock, your correspondent, Mr. Fennings, proposes an external pendulum. I made use of this construction some time ago (but with a different object in view), and found it extremely inconvenient. It is besides uncouth in appearance, and exposes the knife edge of the pendulum itself to extraneous injury. We may effectually close the objectionable aperture, by simply adding to the pendulum-rod a piece of flat thin metal, which shall vibrate with it, and, being a segment of a circle, always be at the same small distance from the clock case. In the annexed figure, A is the metal piece which must be on the *outside* portion of the rod, otherwise the pendulum could not be detached from the works; B the segmental longitudinal aperture in the lower piece of the clock frame.



I cannot concur in "A. H.'s" suggestions as to the cause of the tendency of locomotives to run off the rails. Unless we suppose the springs to admit of considerable lateral action, we must look upon the alternation of the forces from the cylinders as not at all affecting the motion of the engine as a system of rigidly connected bodies, in fact, as a species of "molecular forces." But "A. H." seems to presuppose rigidity, and then speaks of a certain interval of time which we must imagine consumed in the transmission of force along the connecting rod and the axle. If we are to do so, I grant that we thus solve the difficulty; but I should suspect that when a locomotive is in motion, the first elasticity of the parts, acting (especially in the axle) as torsion, will always be held, so to speak, *in suspension;* that is to say, that all forces except those acting at starting will be instantaneously transmitted.

Among the latest improvements in railway engines has been the lowering of the centre of gravity—to me there appears no sufficient reason for not submitting the carriages to the same alteration. I would propose that the main beams of the carriage be below the axles, the springs either suspending the carriage and attached to such beams, or, if you will, vertical spiral springs.

The wheels would then be partly within the carriage; but I conceive that by thus lowering the centre of gravity we might make the cases covering the wheels to be *the division separating the passengers' place next to the window.*

Thus steps and their inconveniences would be unnecessary; and besides a lessening of the atmospheric resistance to high velocities, we should obtain great facilities for the carriage of luggage. The following sketch shows one-half of a six-wheeled carriage, built on the foregoing principle:

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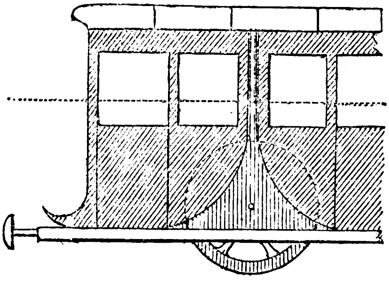

The dotted circle shows the periphery of the wheel, and there will be all this circular space available, to the depth of about six inches, for the springs and drags. With the same radius of wheel, the beam carrying the buffers in a carriage of the ordinary construction, would occupy the position of the horizontal dotted line. Although I am aware that on the Great Western line some of the wheels are partly within the flooring of the carriages, I have not hitherto *seen* any suggestion of the above construction.

I am, Sir, yours, &c.,
JOHN MACGREGOR.

COMPARATIVE STATEMENT OF THE MERITS OF COOK AND WHEATSTONE'S DOUBLE-NEEDLE TELEGRAPH, AND BRETT'S ELECTRIC PRINTING TELEGRAPH.

Sir,—In your Notices to Correspondents, No. 1239, you say, that it is superfluous to inquire as to the merits of Messrs. Brett and Co.'s system of electric telegraph, which you admit is exceedingly ingenious; but that it, as well as all other systems, is about to be entirely thrown into the shade by an invention of Mr. Bain, with which he promises to give 1000 letters a minute. Are we to understand, Sir, that you allude to the electric printing-telegraph, invented by J. Brett, Esq., which is coupled with that wonderful masterpiece, the oceanic line, of which Mr. J. Brett is the originator and sole patentee? If so, all must readily agree with you that it is exceedingly ingenious; but for my part I cannot rest satisfied with a mere assertion of this kind. If there is any merit, it will not be superfluous to show what it is, in order that we may see clearly what has been, and what may be done on either side of the Atlantic. What will your readers say to 3000 letters per minute, such as promised by Mr. Brett's latest improvements? In the absence of a more able advocate, I will undertake the office, feeling assured that the columns of your valuable journal are ever open to the record of inventions of merit; and I trust I shall be enabled to prove that this truly original, and I may say most perfect invention, has the precedence of all other telegraphs hitherto invented. Before entering, however, on my task, let me take this opportunity of thanking you for the timely publication of inventions of my own, in connection with electric telegraphs: namely, two electro-magnetic current deflectors, either of which is applicable to any kind of electric telegraph. It is to you, Sir, that I owe their protection, although at the sacrifice of making them public property. I am, Sir, yours, &c.,

WM. HENRY FRENCH.*

14, James-street, Covent-garden,
April 30, 1847.

Comparative Statement.

The great superiority of Brett's electric printing telegraph over that in present use, namely Cook and Wheatstone's double needle telegraph, can be shown in no way perhaps so satisfactorily as by stating *seriatim* what the objections are to the one system, and how they are remedied by the other.

First Objection.—Cook and Wheatstone's telegraphs are attended with unnecessary expense and inconvenience, from each series of instruments requiring two wires with the earth connection, so that a double number of wires are required to complete every distinct series of instruments; consequently, when there are six, twelve, or any even number of wires, there can be only half that number of distinct series of instruments.

Brett's telegraph requires only one wire with the earth connection to complete a set of instruments; consequently

---

* There are two gentlemen of the name of Brett connected with electro-telegraphic inventions,—Mr. Jacob Brett, who took out a patent November 13, 1845, and Mr. Alfred Brett, who, in conjunction with a Mr. Little, has a patent dated February 11, 1847. It was to the former we made allusion. The invention of Messrs Brett and Little has not been yet specified or made public. We were not aware that Mr. Jacob Brett contemplated any such prodigious stride as "3000 letters per minute;" and may observe that there is nothing in the present statement of his "advocate" to show that his plan is of such wondrous power.—ED. M. M.

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where there are six, twelve, or any number of wires erected, there will be an equal number of distinct series of instruments, which is less expensive and more convenient.

Second Objection.—The wires of Cook and Wheatstone's telegraph are exposed to the influence of atmospheric electricity. I have frequently known the lightning not only to cause uncertain signals, by deflecting the needles and ringing the alarums, but even to fuse the coils of the instruments, and thus render them useless.

Third Objection.—The wires are much exposed to accidental injuries, and generally most so when the agencies of the telegraph are most required. I have never known an engine or train to get off the line without destroying, or at least forcing the wires into contact. The projection of luggage, and shunking of luggage-trains, very often interferes with the wires; and the use of the telegraph is often suspended by the unavoidable removal of the wires during the alteration and building of sheds, stations, &c., casualties to which a railway is ever subject. The wires frequently get in contact by their unequal elongation in summer, and snap by their contraction in winter. The branches of trees and the arms of signal-posts are also calculated to bring the wires into contact. The string too used in flying of kites frequently becomes entangled with the wires, and draws them together—if not sufficiently close to connect them, yet so close as to produce contact, when the string becomes wet either from rain or a humid atmosphere.

Fourth Objection.—Exposure of the wires to wilful injury. Even if guarded by a protective police, which would be attended with an enormous expense, they would still be liable to be greatly interfered with from this cause. Guard them as you may, it can be no hard task for an evil disposed person to sever the wires, or connect them by resting a rod of iron upon them, and thereby bringing them in connection with the earth; or they may be connected by the easier method of throwing a string across them, and drawing them by means of it together. The evil effects of contact in the wires of Cook and Wheatstone's telegraph is easily discernible in the action of the needles of both wires. When the needles of one wire only should be acted on, they may be seen deflected as follows: The needles of No. I wire will point to the right, as far as the place of contact; when the fluid, returning by No. II. wire, will deflect the needles in No. II. in the contrary direction to the left: the surplus fluid will then travel along the remaining portion of both wires, on the other side of the contact, and so deflect the needles of both wires in the same direction, to the right (see fig. 1 of the accompanying engravings). By following the arrows in fig. 1, the reader will be enabled to trace three distinct circuits instead of two. One circuit is made between No. I and No. II. wires, on one side of the contact, which causes the needles of both wires to be deflected in contrary directions. The two other circuits are made, one between No. I. wire and the earth, and the other between No. I wire, on one side of the contact, and No. II wire on the other side of the contact and the earth, thus causing a confusion in the signals of the dial. Instead of the needles of No. I. wire only being deflected either to the right or left, by a circuit being made between No. I. wire only, and the earth (which may be traced between the arrows of fig. 2), the needles of No. II. wire, being undisturbed, would remain vertical, although at the same time they can be brought into action if required, the circuit being formed by the earth also. Under such circumstances alone can the signals be carried on. The destruction of an earth circuit would be attended with a confused deflection of the needles of both wires, when the needles of one wire only were intended to be acted on; the only circuit being that of the wires (see figs. 3 and 4). The needles, by one direction of the fluid, would be convergely deflected (fig. 3); while by another direction of the fluid they would be divergely deflected (see fig. 4). The result of a broken wire requires no comment; it being a well-known law of voltaic electricity that no electric action can take place without an entire circuit. Consequently, under such circumstances, this system is rendered useless.

The second, third, and fourth objections are effectually obviated by the use of Brett's oceanic line, which is secretly

Fig. 1.

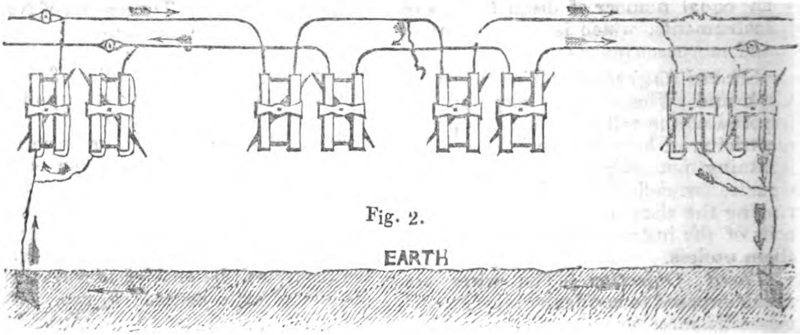


Fig. 2.

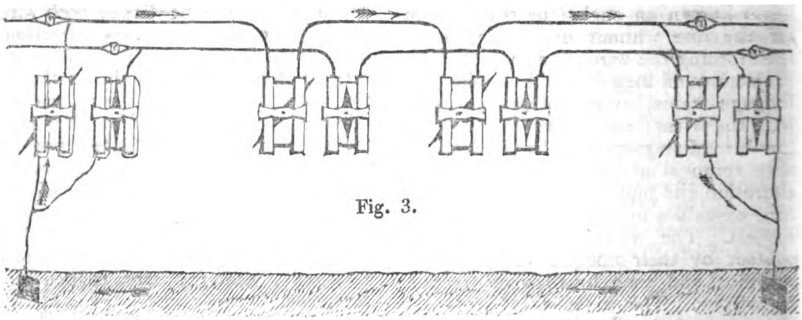


Fig. 3.

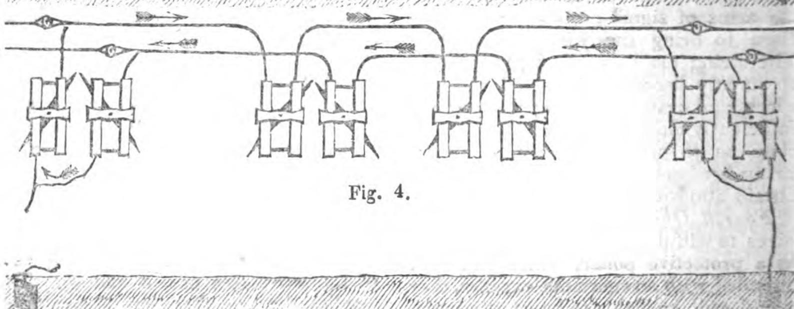
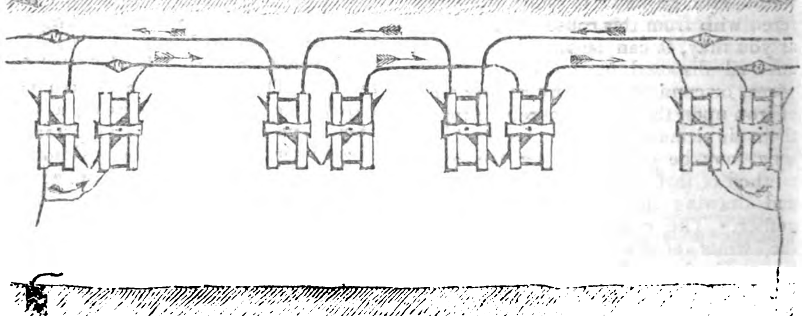


Fig. 4.



and securely deposited in the earth, where it is not only protected from atmospheric electricity, but from all accidental and wilful injuries, and every other sort of interference to which the suspension system, and Cooke and Wheatstone's instruments, are ever exposed. Even if it were possible for one wire of Brett's telegraph to get into contact with another wire, the communication would neither be confused, nor destroyed. As the mechanical movement cannot retrograde, it will not matter in what direction the fluid travels. The signals will therefore be given with unerring accuracy. The only evil (if such is an evil) that could happen under such circumstances would be, that the instruments of both wires might be set in action, and a double series of copies be then produced. If it were possible for the wires to be cut asunder the signals of Brett's telegraph would not even then be destroyed, because the electricity would immediately find its way through fragments of the earth lying in contact with the ends of the several wires; and thus form circuits, up and down the line, from the place of accident—to and from which place a communication could still be maintained on either side of the separation.

Fifth Objection.—Cooke and Wheatstone's telegraph is liable to great variation in the deflections of the needles, and in the attraction and re-action of the electro-magnets; arising from the fluctuation of the battery power—electricity alone being the motive power. For illustrations of the uncertainty attending the ringing of alarms see current volume of this Journal, page 279, and note, page 398.

Mr. Brett avoids these sources of disturbance by employing as his motive powers mechanical and hydrostatic or pneumatic agencies—reserving the electricity to regulate his printing telegraph, whereby all the effects desired are obtained with greater certainty and at a far less expenditure of electricity.

Sixth Objection.—The absolute necessity of previous tuition, in consequence of the whole of the signals of Cook and Wheatstone's telegraph being conventional and complicated, and some of them having double and sometimes threefold meanings affixed to them.

In Brett's printing telegraph the several letters of the alphabet are separately printed, and indicated by one consecutive movement, emanating from the movement of a corresponding letter on the finger board, on which every letter, without any omission, is alphabetically arranged. All complication and uncertainty are thus removed, and, consequently, all necessity for previous tuition; even a child knowing its letters may operate with certainty.

Seventh Objection.—Numerals are indicated in the same manner as several letters of the alphabet, from which they are only distinguishable by the use of a preparatory signal, which signal happens to be the same as one of the letters of the alphabet! From the great uncertainty attending this threefold use of the same letters signals are often misunderstood, and consequently obliged to be repeated many times (fig. 1, page 401, present volume).

In Brett's telegraph the numerals and other characters are introduced on the finger board, on the dial, and on the periphery of the type wheel, whereby all misconstructions and necessity for repetition are removed.

Eighth Objection.—Want of certainty in the communications, arising from the unsteadiness of the needles (see current volume of this Journal, page 400)—from the probable inability of many of the clerks to read off the signals—from the omission of some of the letters of the alphabet, and the double and threefold meanings attached to others—from frequent inattention, and sometimes want of confidence in the clerks, &c.

All these sources of error are avoided in Brett's telegraph, by a faithful copy of all communications being printed, and the same being indicated by a rotary needle pointing to each letter, at the very time it is printed; thus removing all uncertainty as to whether some of the movements of the needle or needles are intended to indicate a letter, or a figure, or a preparatory signal, or merely the result of the oscillation of the needle, &c. No chance of a clerk's interpreting inaccurately what a child can transmit effectually. Nothing to fear from inatten-

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tion, since each communication can go on without the absolute necessity of each word being acknowledged, or preparatory signal guide—a most important advantage this when it happens that railway clerks are engaged in starting a train, or in some other important occupation. No risk of signals being erroneously transmitted, since the same agency by which they are made at one end produces them in duplicate at the other.

Ninth Objection.—The unavoidable loss of time in transmitting or receiving, and acknowledging each word, &c., and occasionally repeating, and stopping to copy and recopy the communications.

In Brett's Telegraph there is an uninterrupted transmission or reception of entire communications, without any necessity for acknowledging each word, or of occasionally repeating and stopping to copy and to recopy, or even copying the communications at all, or of any loss of time from conventional or from preparatory signals. Besides, this system has an advantage which will accelerate all urgent communications, namely,—the use of a rotary needle, by which the entire or detached portions of a communication may be read off, and despatched if required, without even waiting for the copy, which may immediately follow, or may be sent to other parties concerned.

Tenth Objection.—The unnecessary occupation of several instruments, by reason of the confused appearance of the signals on some of the dials of Cook's and Wheatstone's apparatus, while any two instruments of the same series are in communication with each other. As all signals require acknowledgments, which can be done only at one instrument at a time, these acknowledgments, whether indicating "understand" or "not understand," will appear as part of the communications on all other dials, except on the one communicated with; in consequence of which, it is scarcely possible for any communication to be understood at any other station, because the recipient may give "understand" when other stations do "not understand," or give "not understand," when other stations do "understand." None but the stations communicating are allowed to touch the instruments at the time; consequently other stations are kept in ignorance for a considerable time, and parties, requiring assistance, may thus be altogether deprived of that assistance.

With Brett's telegraph all communications will be simultaneously printed and indicated at all the stations of a line, and the promptest assistance be thus rendered in every case of emergency.

Eleventh Objection.—The possibility of reading the communications at all the stations within a circuit, though intended for one only.

Mr. Brett can throw any distant station or number of distant stations, in or out of communication at pleasure.

Twelfth Objection.—Every series of Cook and Wheatstone's telegraphs requires the sole attention of at least three persons, one to transmit, a second to receive, and a third to convey the communication to its destination, or to attend to the instruments while the same is being copied and conveyed. When a communication is intended for more than one station, it further requires the sole attention of at least two other persons, for the transmission and reception of the communication at each station.

Brett's telegraph requires only one person to transmit a communication to any number of stations at the same time without engaging the attention of the recipient, the same being printed without any assistance, and even during the absence or repose of the recipient. The distance, actually proved up to the present time to act with certainty by this telegraph in one continuous line, has been 230 miles and 340 miles apart, and at the rate of 100 letters per minute. Upwards of 4,000 miles of this telegraph have been completed in America.

I am informed on good authority that the machines for general purposes will compose and print, in a given time, as much matter as two or three compositors could set up in form, ready (only) for printing, viz., from 100 to 300 letters per minute; and that by certain recent improvements Mr. Brett can produce machines adapted for special purposes, capable of printing *from* 300 *to* 3,000 *letters per minute.* W. H. F.

(*To be continued.*)

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THE LATE MR. HOLTZAPFFEL.

The mechanical world will have noticed, with universal and deep regret, the death of Mr. C. Holtzapffel, while yet in the prime of life, and while in the midst of those literary labours which, incomplete though they be, have gained for him an imperishable name. We repeat with undiminished confidence in its truth, what we said in reviewing the last volume of the *Mechanical Manipulations* which passed through his hands, that there has been "no work on the mechanical arts produced in this country during the present century that is to be at all compared with this for newness, exactness, and completeness of information." Workshops, and not libraries, were the great sources from which the author filled his instructive pages. We can hardly hope to see so great a loss as mechanical literature has sustained by his death soon repaired; but it is some consolation to learn, as we do by a Circular from his Executors, that "considerable portions of the third and fourth volumes have passed through the press under the author's own superintendence; and that he had in great forwardness much of the manuscript for the completion of these volumes, which will be submitted to the public at the earliest possible period."

EXPERIMENTS IN BLASTING WITH GUNPOWDER AND GUN-COTTON.

Experiments on the Holyhead Mountain.

No. of Experiments.	Depth of Hole.		Diameter of Hole.	Distance of Hole from face of Rock.		Weight of Powder used, in Ounces.	Weight of Cotton used, in Ounces.	Weight of Stone removed.	Remarks.
	ft.	in.	inches.	ft	in.	oz.		tons.	
1	4	0	1¾	3	6	40	—	18	Much broken, and thrown from the face.
2	4	6	1¾	4	6	40		19	Not so much broken, but easily removed.
3	4	0	1¾	4	0	—	paper tube. 8 oz.	17	Removed in large blocks, one weighed 2½ tons.
4	4	6	1¾	6	0	40	—	16	
5	3	1	1¾	5	0	—	loose. 10 oz.	17½	
6	3	1	1¾	4	0	—	tube. 6 oz.	9	
7	3	1	1¾	4	0	—	tube. 6 oz.	8	
8	3	6	1½	3	6	16	—	2	
9	3	0	1¾	3	0	—	tube. 6 oz.	—	Not weighed.
10	3	0	1¾	2	0	16	—	2½	

The character of the Rock is metamorphic, a mica and chloride slate, exceedingly hard, but much ruptured.

JOHN F. WHEELER.

Royal Hotel, Holyhead, April 30, 1847.

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Experiments in Blasting with Gun-Cotton and Gunpowder at Mr. Holland's Slate Quarry, Ffestiniog, Merionethshire.

No. of Experiments.	Depth of Hole.		Diameter of Hole.	Distance of Hole from face of Rock.		Weight of Powder used, in Ounces.	Weight of Cotton used, in Ounces.	Weight of Stone removed.	
	ft.	in.	inches.	ft.	in.		tube.	tons.	
1	2	3	1¼	2	0	—	4 oz.		In stemming down the fuse was cut. The stemming drawn out and cotton fired, split the stone 4 feet down.
2	2	3	1⅜	3	0	16 oz.	—	2½	
3	2	2	1⅜	3	0	—	tube. 4 oz.	3	
The above Experiments were made upon an exceedingly-hard calcareous Stone.									
4	3	6	¾	3	6		2 oz.	—	The slate cracked, but not removed.
5	2	0	¾	1	4	6 oz.	—	—	Did not fire, "smoked."
6	2	1	¾	2	6	—	1¾ oz.	2½	This was in a fast place, removed the slate in a fine piece.
7	5	0	¾	5	6	—	3¾ oz.	9	Removed in fine and valuable pieces.
8	2	0	¾	5	0	—	2 oz.	—	Removed from its bed in fine large pieces.
9	2	6	¾	4	6	16 oz.	—	4½	Shattered and thrown about in useless pieces.

Tan y Bwlch, Ffestiniog, May 3, 1847. JOHN F. WHEELER.

We have been favoured this week by Messrs. Hall and Son with copies of the following additional communications.

Messrs. John Hall & Son,

Gentlemen,—Yesterday farther trials in blasting with the patent gun-cotton were made at the Flaybrick Quarry, Birkenhead; a statement of the result is annexed. This quarry is now being actively worked, getting stone for the Birkenhead Docks in busy progress; the stone is a freestone.

Mr. Brown, the resident engineer to the works, together with several gentlemen, accompanied me to the quarry to witness the experiments; the results of which, I am pleased to state, fully satisfied all of them, that the use of gun-cotton for quarrying purposes was eminently superior to that of gunpowder; in every instance the gun-cotton relieved from the bed large masses of stone of a size best adapted for those works, or any of similar magnitude; many of the blocks weighed from four to seven tons. The few trials made in this quarry proved most satisfactorily to all present, that the amount of saving to the contractors from there being no waste or spoil would be very considerable. I am, Gentlemen,

Your obedient servant,

JOHN F. WHEELER.

Liverpool, May 7, 1847.

No. of Experiments.	Depth of Hole.	Diameter of Hole.	Distance from the Face.	Quantity of Cotton used.	Quantity of Powder used.	Quantity of Stone removed.
	ft. in.	in.	ft. in.	tube.	oz.	
1	5 0	2¼	5 0	10oz.	—	18½ tons.
2	4 7	—	5 6	10oz.	—	17½ ,,
3	4 6	—	5 6	8oz.	—	14 ,,
4	5 4	—	8 0	10oz.	—	——
5	4 9	—	5 6	10oz.	—	23½ ,,
6	4 2	—	6 4	8oz.		14 ,,
7	4 2	—	5 0	—	40	8 ,,

J. F. Wheeler.

Liverpool, May 8, 1847.

AMERICAN PATENTS.

The American Commissioner of Patents has just made his Annual Report for 1846. We quote the following abstract of it from the *New York Herald* of the 15th ult. :—

During the year ending December 31, 1846, the whole number of applications for patents received, was twelve hundred and seventy-two. The whole number of caveats filed during the same time was four hundred and forty-eight. The number of patents issued in 1846 was six hundred and nineteen, including thirteen re-issues, five additional improvements, and fifty-nine designs.

During the same period, four hundred and seventy-three patents expired.

Three applications for extensions were made during the year; two of which were rejected, and one is still pending. Two patents have been extended by Congress during the same period.

The receipts of the office during 1846, including duties and fees paid in on application for patents, caveats, re-issues, additional improvements, extensions, and for copies, amount in the whole to 50,264 dollars 16 cents; of which sum, 11,086 dol. 99 cents have been repaid on applications withdrawn, and for money paid in by mistake.

The aggregate of expenditures under the different heads above enumerated, including money paid back on withdrawals, and for the restoration of records, drawings, and models, is 46,158 dol. 71 cents, leaving a balance to be carried to the credit of the patent fund of 4,105 dol. 45 cents.

On the first day of January, 1845, the amount of money in the treasury to the credit of the patent fund was 182,459 dol. 69 cents, which, with the balance paid in during the year 1846, will, on the first day of January, 1847, amount to 186,565 dol. 14 cents.

Although the balance which the office has been able to place to its credit in the treasury during the year just past, in consequence of the decreased amount received on application for patents, caveats, &c. (there being fewer foreign applications during the last year), and the additional amount refunded to the applicants on the withdrawal of their claims, is not so great as that of the previous year, yet it is more than the average balance of former years, and indicates the flourishing condition and prospects of the Patent Office.

"Thus far," says the Commissioner, "the office has more than sustained itself, and fully realized anticipations when it was reorganized upon its present footing; and if a conclusion may be drawn from the activity of the inventive genius of our countrymen, as exhibited in past years, we may rely confidently on the belief that this useful and noble institution of the government will never become a charge upon the treasury."

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HANN'S "SHORT TREATISE ON THE STEAM-ENGINE."*

"Short," but good. We do not think, indeed, that we shall be exaggerating the merits of this work, if we say, that compared with all previous works on the subject, whether short or long, it has not its equal. Learned yet simple—alike adapted to the comprehension of the scientific engineer, and of the practical mechanic — wholly occupied with principles and results — concise, exact, and clear—it is not only an excellent book to learn by, but one which may be safely relied on for ready reference in the course of business or study.

Originality in the matter of a work of this sort is not so much looked for as a correct enunciation of known and established truths. Yet is there much of real originality in several parts of Mr. Hann's treatise. We may notice in particular the section on Parallel Motion, which has never, we think, been so well handled before. He points out some gross mistakes of Millington—rescues the subject from the mass of abstruse calculation in which it has been enveloped by Willis—and reduces the whole affair to such simple elements, that any one who understands the common rules of arithmetic may easily calculate all the parallel motions which occur in steam-engine practice.

In treating of the duty of an engine, Mr. Hann gives a formula communicated to him by Mr. Tate (of whose papers on Steam Power in the *Mech. Mag.*, vol. xl. and vol. xli., he speaks in terms of high commendation), which gives the relation between the volume (V) and the pressure (P) of steam, raised from a unit of water, much more nearly coinciding with practical results than any other yet given. The formula is this:

$$V = m + nP^{a}.$$

Where $m = 12{\cdot}5$, $n = 20570$, and $a = {\cdot}9301{\cdot}9301$. In proof of the superior accuracy of this formula, Mr. Hann gives the following comparative table:

P in pounds per square inch.	*V* derived from experiment.	*V* calculated from the proposed formula.	*V* calculated from Pole's formula.	Errors of the proposed formula.	Errors of Pole's formula.
5	4617	4617	4915	0	+ 298
6	3897	3897	4106	0	+ 209
7	3376	3378	3529	+2	+ 153
10	2426	2428	2480	+2	+ 64
12	2050	2050	2085	+1	+ 35
15	1669	1668	1681	−1	+ 11
16	1573	1573	1580	0	+ 7
18	1411	1411	1412	0	+ 1
20	1281	1281	1277	0	− 4
30	883	882	873	−1	− 10
40	679	678	671	−1	− 8
50	554	553	550	−1	− 4
60	470	469	470	−1	0
70	408	408	411	0	+ 3
80	362	362	368	0	+ 6
90	325	325	334	0	+ 9
100	295	296	307	+1	+ 12
120	251	252	267	+1	+ 16
150	205	206	226	+1	+ 21
160	193	195	216	+2	+ 23
180	174	176	199	+2	+ 25

For the special use of working men Mr. Hann gives a number of well selected examples worked out at full length by common arithmetic. But, indeed, there is scarcely anything throughout the book which a person moderately skilled in calculation cannot perfectly understand; for wherever the least difficulty appeared a practical rule has been inserted.

A valuable table of hyperbolic logarithms is given at the end, which will enable those who understand the integral calculus, or even those who work only from formulæ, to find very easily the number of units done at each stroke.

* A Short Treatise on the Steam-engine, adapted to the use of Schools. In which are given "Practical Rules for the Use of Engineers." Part I., 101 pp. 12mo.

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MESSRS. OATLEY AND SON'S SELF-ACTING VENTILATOR.

[Registered under the Act for the Protection of Articles of Utility. William Oatley, senior, and William Oatley, junior, of No. 25, Aldermanbury, London, Inventors and Proprietors.]

Fig. 1.

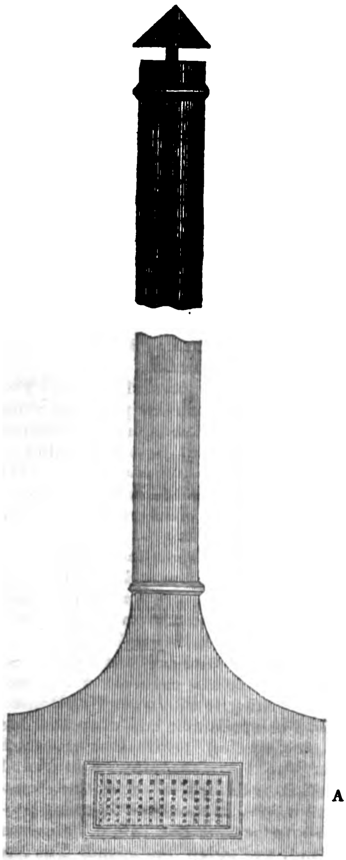

Fig. 2.

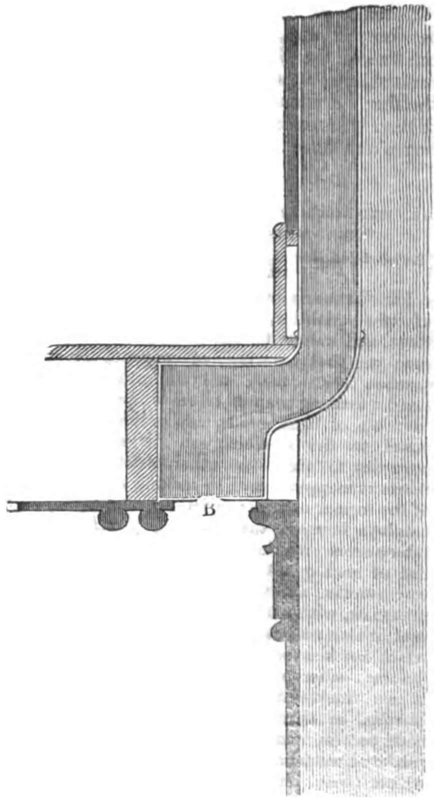

Fig. 1 is a front elevation of this apparatus, as fixed behind the skirting of a room, and carried up through the roof. A is a box of stout sheet copper, 1 foot 8 inches long, 7 inches wide from front to back, and 9 inches deep. In the front of this box there is an opening, 9 inches by 4 inches, (11½ inches from the bottom of the box), which is covered with a perforated brass or copper ventilator, fitted in a frame, and secured to the box by screws, so that it may be removed occasionally to clear any dust that may accumulate in the box or flue. The flue is 4 inches square, and manufactured in lengths of 5 feet, 10 feet, or 20 feet, as required, the edges at the joinings being turned over and soldered air-tight, and the undermost length being soldered into the top of the box A. Care is taken that every joint is air-tight. The flue is surmounted at top by a conical cap.

Fig. 2 represents the manner in which the apparatus is applied to the top of a room. It is proposed to fix it at each angle in the plancial of the cornice, as shown; but the ventilator B, instead of being in the front, is placed at the bottom of the box.

In applying the apparatus to the roof of a room with other rooms above it, the

box should be so constructed as to fit in between the floor of the room above and the ceiling of the room proposed to be ventilated.

The flue, instead of passing straight upwards through the roof, as represented in fig. 1, may be carried in a slanting direction, and terminate in an orifice in the outside wall, chamferred off to suit the size of the flue, and filled with perforated copper, soldered to the mouth of the flue. Each apartment requiring ventilation is intended to have separate air-boxes and flues.

MR. HENSON'S IMPROVED GOODS' WRAPPERS, WAGON COVERS, ETC.

[Patent dated Nov. 5, 1846; Specification enrolled May 5, 1847.]

Mr. Henson manufactures his new fabric of two qualities, one very strong and stout, and suited to out-of-door purposes, such as the covering of wagons, stage coaches, carts, &c.; and the other of a slender texture, adapted to the wrapping and covering of light goods, not ordinarily exposed to the weather, and for all other purposes to which the other variety of the fabric is inapplicable. In making the fabric of the former of these varieties he ordinarily employs hempen thread—but, *firstly*, he interweaves with the hempen thread a material of such quality that it will not rend or tear asunder, and will not readily allow the materials, with which it is interwoven, to be rent or torn; *secondly*, he subjects the fabric, which has been so composed, to a process of tanning, whereby the hempen portions of it are thickened and strengthened; and, *thirdly*, he saturates and coats the fabric with certain compositions, by which it is rendered waterproof. And the manner in which these different processes are performed, and effects produced, is as follows:

Firstly, he interweaves with the hempen threads, while the fabric is passing through the loom, a certain number of strands or threads of copper wire, wound round with thread; or of iron wire, which has been previously zinced, or as it is commonly termed, galvanized, and also wound round with thread; or instead of either sort of wire, very thin strips of cane (covering the wire with thread is recommended, but it may also be used uncovered). The wires, or cane strips may be inserted, at from 1 to 6 inches apart, according to the degree of strength required, and the thickness of the wire or cane strips employed; and they may be inserted either in the warp or woof. Mr. Henson states that he finds, for the general run of fabrics of this class, that wire, known in the market as of the gauge, No. 28 is very suitable; and that when such wire is used every requisite degree of strength and tenacity is obtained by inserting it at distances of 2 inches apart.

Secondly, This compound fabric is immersed in a vat filled with tanning liquor, of such strength as may be obtained by using $1\frac{1}{4}$ cwt. of good oak bark for every 100 gallons of liquor; and the piece immersed is so proportioned to the quantity of the liquor, that for every yard of the fabric there shall be about two gallons of liquor. He then heats the liquor to about 155°, and keeps it at this temperature with the fabric immersed in it for about fifty hours; turning the fabric from time to time in order that it may be in all parts equally saturated with the liquor. He then removes the fabric from the vat and hangs it up to dry, before subjecting it to the third, or water-proofing process. Should it be desired to give the fabric still more of the quality of leather than is producible by the preceding process, this may be effected by farther immersing it in a weak solution of gelatine or albumen, for about ten hours; and repeating this operation two or three times, or oftener, according to the quality of tannate which it may be deemed expedient to precipitate upon the fabric. Instead of employing the preceding process of tanning, either of the well-known processes of tanning by exhaustion, or hydraulic pressure, may if preferred be employed.

Thirdly, After the fabric has been so far prepared, the whole is rendered waterproof by first saturating it with what Mr. Henson calls No. 1 composition; and when that has become dry, coating it with another, which he calls No. 2 composition. The No. 1 composition is formed of turpentine, bees-wax, and tallow, in about the following proportions: turpentine one gallon, bees-wax one pound, and tallow one pound. The No. 2 composition is formed of the following ingredients in about the proportions annexed thereto respectively: raw linseed oil two quarts, boiled linseed oil (rendered drying by a mixture of litharge) one quart, Stockholm tar one quart, and lamp black or ground charcoal (the finer the better) 20 ounces. To facilitate the application of these compositions the patentee makes use of a steam apparatus of the following description. On a basement, or foundation of brickwork, is placed a hollow table $A^a A^a$, which is formed of horizontal iron plates connected by, and made fast to vertical iron plates or beams, as shown, and is closed in at the sides and ends so as to render the whole perfectly steam-tight. There are

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pipes for the admission of the steam, and other pipes for allowing any excess of steam to escape; G is also a cock through which any water resulting from the condensation of the steam may be drawn off. The fabric, when about to be saturated or coated, is laid upon the table, and the composition No. 1 or No. 2 (as the case may be) is laid on by means of a spatula or brush. It is to be observed, however, that in applying No. 1 composition, the endeavour of the operator should be to force the composition into and through the fabric, while in applying No. 2 the object desired will be fully obtained by laying it on evenly and smoothly.

In manufacturing the fabric of the second of the qualities before mentioned, that is to say of a quality suitable for the wrapping or covering of goods of a light quality, not ordinarily exposed to the weather, or for any other purposes not requiring a fabric of so stout a description as that first described. Mr. Henson proceeds as follows: — He takes a sheet, or web of paper, and pastes, cements, or otherwise unites it to a sheet, or web of calico, or some other like textile fabric, which has been previously waterproofed and japanned by any of the well-known processes in use for these purposes.

REMEDIES FOR THE BREAK OF GUAGE.

Sir,—In No. 1231, March 13th, of your valuable publication, I observe a description of a system, patented by Mr. Henson, for transferring railway carriages from the narrow to the broad guage, or *vice versâ;* I beg leave to offer a few observations on the subject, as it appears to me that the ingenious plan proposed by the talented patentee will fall short of his expectations, and for the following reasons:—

It no doubt, at first view, seems an excellent contrivance, as far as theory is concerned, to obviate the defects and inconveniences so long with much justice complained of in the break of the guage; and as the objections are of a practical nature, and will explain themselves, it is unnecessary to enter into any long disquisition.

In the first place, Mr. H. proposes to convey the carriages on trucks, which, as a matter of course, must raise the carriage considerably from the rails. This would be a serious objection. The bridges and tunnels even at present allow scarcely sufficient room for the carriages to pass under in safety, and consequently if the carriages were raised higher, would not allow them to pass at all.

Secondly, the delay caused by changing from one train to another would be but partially remedied, as each truck would have to be brought up separately, and when the carriage was secured in its place, removed, and another advanced to receive its load. It is scarcely necessary to add, that in case of long trains this would be a very tedious operation.

And, lastly, the enormous expense of manufacturing the large number of trucks necessary to carry out Mr. Henson's system, would effectually deprive the company of any slight advantage that might accrue from Mr. Henson's improvement on the plan that was some time since laid before the Guage Commission.

At the same time that I make these observations respecting Mr. Henson's system, I am induced, by a conviction that the evil in question cannot be without its remedy in some shape or other, to bring under the notice of scientific men another plan, proposed by a practical observer of the railway system as at present in operation, which seems to me to possess great simplicity, and very likely to be just the thing wanted.

It is simply this,—to have *two pair of wheels* on each axletree, one pair suitable to the broad gauge of 7 feet, and the other pair to the narrow gauge of 4 feet 8½ inches; which arrangement would allow the same carriages to run equally well on either line of rails.

The advantages I conceive this plan to possess are, in the first place, that the position of the carriage would not be altered; secondly, no delay can arise where the gauge breaks (which is a matter of the *utmost importance*), as the narrow gauge meets the broad in the centre, so that when one pair of wheels left the rails on the narrow gauge, the other pair would immediately take the rails on the broad gauge, or *vice versâ*, and the train would be able to proceed without the slightest obstruction, except the momentary delay requisite to change engines, and which might, perhaps, also be overcome by the same means. And, lastly, the cost of the necessary alterations will be comparatively trifling, when weighed against the immense advantages that would be acquired. The carriages of the broad gauge would only require an extra pair of wheels on each axletree; the axletrees on the narrow gauge would, of course, require a slight alteration to receive the second pair of wheels, which, by a simple contrivance, might be made to support and strengthen each other, and, by this means, be rendered stronger than with one pair of wheels only. This, together with a little alteration in the points and crossings, would be all the expense that need be incurred, to make a permanent improvement in those railways on which the

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traffic is at present so much interrupted by the break of the gauge.

H. L. C.

Dublin, April 13, 1847.

[We think our correspondent has exaggerated the difficulties attending the plan he objects to, and greatly underrated those of his own. Mr. Henson's trucks need not rise more than about two feet above the level of the rails; and there are no bridges or tunnels so low as to make so small an increase of elevation an objection. Now what does "H. L. C." propose? To add an extra pair of wheels to every axle, which would be equivalent, in the case of a four-wheel engine, to adding from 8 to 10 cwt. of dead weight to what is but too heavy already. And in order to adapt the axles to receive these extra wheels, he proposes to make what he calls a "slight alteration" in them, but which would, in fact, amount to nothing less than lengthening the whole of them a foot or two. Such utter changes are not to be thought of. —Ed. M. M.]

SMITH'S GUTTA PERCHA SAFETY FUZE.

[Patentee Mr. George Smith, of Camborne, Cornwall, Safety-fuze manufacturer. Patent dated November 12, 1846. Specification enrolled May 8, 1847.]

The object of the present invention is the manufacture of Safety Fuzes, in such manner and of such material, that they shall be less liable to injury from changes of atmospheric temperature, damp, or the action and pressure of water, when employed in submarine operations. Mr. Smith states that this is best effected by employing gutta percha to enclose an interior cylinder of gunpowder; or as a coating, or covering, for the ordinary hempen fuzes.

That part of the invention which relates to the enclosing of an interior cylinder of gunpowder with gutta percha, is performed in the following manner:—A cylinder of iron, or other suitable metal, capable of supporting a pressure of 500 lbs. to the square inch, and made at its lower extremity of the form of an inverted cone, is surrounded with a casing, between which and the cylinder steam is allowed to circulate.

The lower part of the cylinder, that is, the apex of the inverted cone, terminates in a pipe, which is carried down through a cistern of cold water. A gunpowder chamber, or funnel, is supported by suitable bearings in the centre of the cylinder, and, passing through the inverted cone, terminates in the pipe below the joint.

The funnel is filled with gunpowder, having a thread through the centre thereof, to facilitate its passage; and the cylinder with gutta percha. The steam is made to circulate between the cylinder and outside casing, until the gutta percha assumes the consistency of putty. It is then pressed through the pipe, and, passing round the gunpowder funnel, takes the form of a hollow tube, while it becomes filled with gunpowder. The fuze, in passing through the cold water cistern, acquires a degree of firmness, which may be increased by causing it to pass between two rollers, grooved on their peripheries, and made to revolve in opposite directions.

The ordinary hempen fuzes are also coated with gutta percha in the following manner: An iron cylinder, similar to the preceding, and heated in like manner, is filled with gutta percha, which is subjected to the pressure of about 300 lbs. to the square inch. The sides of the cylinder are bored with holes of different diameters, to suit the size of different fuzes, to which inlet and corresponding outlet pipes are attached. When the gutta percha is sufficiently softened, a wire, hooked at the end, is attached to the fuze and made to enter one of the inlet pipes, and, passing through the mass of gutta percha, to come out at the exit one opposite. The fuze is cooled in its passage through the exit pipe by an arrangement similar to the one before described.

[Mr. Smith has made palpably free with the inventions of two preceding patentees: first, that of Mr. Bewley, of Dublin, of whose method of making gutta percha tubing Mr. Smith's is a literal copy; and, second, that of Mr. Henry Carbines, of Hayle, who claims in express terms the application of gutta percha "to the cementing and waterproofing of fuzes, cartridges, and other like materials."—Ed. M. M.]

HISTORY OF THE INTRODUCTION OF GUTTA PERCHA INTO ENGLAND.

Sir,—In your Number for Oct. 31, 1846, there appeared a letter from Dr. Montgomerie, claiming the merit of having been "the person through whom the new substance, called *gutta percha*, was first brought to the notice of the public;" and various facts are detailed showing the praiseworthy zeal of that gentleman to introduce the article to the attention of several public bodies. Without in the least detracting from the merits and services of Dr. Montgomerie, I am assured that he was not the *first* to introduce this gum to the notice of the English public, but that a prior claim exists on behalf of my friend, Sir Joze d'Almerida, of Singapore. This gentleman having been many years resident in that settlement, came over to England in the beginning of 1843, and brought several samples of the gutta percha with him, and among other channels of communication with the scientific public,

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had the honour of presenting specimens to the Royal Asiatic Society, for which he received their letter of acknowledgment and thanks, dated April 8, 1843, which is now before me.

In justice to my friend, Sir Joze d'Almerida, who thinks himself entitled to the credit of introducing gutta percha to the notice of the English public, I request the favour of the insertion of this letter in your Magazine.

I am, Sir, yours, &c.,
A. A. LACKERSTAN
1, Circus-road, St. John's Wood,
May 12, 1846.

RESPIRATORS.

SIR,—I am one of the vast number of persons who have derived benefit from the use of Mr. Jeffrey's Respirator.

I am also one who has long taken in your Journal, and placed some reliance upon any deliberate expression of your opinion—certainly so far as to give you credit for having carefully examined the grounds upon which an opinion might be formed—and as you have now expressed an opinion in strong terms upon a subject in which I feel a personal interest in forming a correct judgment, I cannot resist the temptation to trouble you with a few lines.

You say, page 338, "The Respirator of Mr. Wroughton is an IMMENSE *improvement* upon that of Mr. Jeffrey's. It has more than all the advantages of that instrument without any of its unsightliness." If I could place confidence in this opinion I should immediately purchase one of Mr. Wroughton's; but on going into your description I cannot perceive the grounds upon which to base your conclusion. Still, as it is my interest to know the truth, for I expect to find comfort and safety from the use of a respirator every year through which it may please God to spare my life in this chilly and variable climate; and as I know that I was prejudiced against Mr. Jeffrey's before I experienced its benefits—permit me to state my present view of the subject, and to request the favour of further information from yourself, or from any of your readers who can speak experimentally upon it.

Mr. J.'s respirator, as I use it, is a widely folded neck-handkerchief, coming half way up the upper lip; and at the upper part, where it covers the mouth and lips, is about one inch in thickness, or somewhat more, according to the power used. In this projection consists its unsightliness. It affords every protection it professes to do—without any feeling of discomfort, and with perfect freedom of breathing and LIBERTY of SPEECH—without danger from its indulgence.

Mr. W.'s respirator is in the form of a silver box, to be placed (if I understand rightly) between the lips and gums, and must, I imagine, cause an unpleasant sensation of fulness and distension, with an unsightly protrusion of the lips and mouth, and an entire DEPRIVATION of SPEECH so long as the respirator is retained in its place.

My old respirator has seen some service, and although I might perhaps now be able to do without it, I feel that, whenever it is desirable to wrap up, it is by far the most comfortable thing to place before the mouth. Waiting for further information before I decide upon purchasing another,

I am, Sir, yours, &c.,
BRONCHITIS.

[We at once concede, that for people who cannot walk abroad without talking incessantly (to themselves or others) Mr. Wroughton's respirator is not suitable. We had in view, in our recommendation of it, its cold-excluding properties alone. The box is a narrow one, and by no means attended with the "unsightly protrusion" supposed.—ED. M. M.]

Scientific Obituary.—Departed this life, at Croydon, on the 10th inst., Miss Vacuana Airy, the celebrated "Fainting Lady." She had never been perfectly well, and latterly was reduced to a most pitiful state of weakness. Her disease was a constitutional asthma. Her lips, which were ever open, gasping for breath, are now, alas! sealed at last. It is thought that, had some of the more eminent members of the faculty, such as Doctors Clark and Varley, Messrs. Cunningham and Carter, &c., been called in to her aid, the lamented deceased might still have been spared to an admiring world. The funeral is to take place on the "Derby day;" Chief Mourners—Jacob Samuda, Esq.; James Pim, Esq.: Pall Supporters—Wm. Cubitt, Esq.; J. K. Brunel, Esq.; Wm. A. Wilkinson, Esq., &c.

THE PLANET NEPTUNE.

Mr. Babbage published a little while ago in the *Times*, a letter, animadverting on the sapient conduct of the Royal Astronomical Society, in ridding themselves of the rival

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claims of Le Verrier and Adams, by awarding a medal to neither;* and this has drawn forth a pamphlet in reply from the pamphlet-loving Mr. Sheepshanks, one of the vice-presidents of the society. It is in the usual style of Mr. Sheepshanks' productions—flippant, personal, and abusive, but clever and piquant withal. We notice the pamphlet, however, not for the purpose of entering into the small-circle squabbles to which it relates, but in order to say a word or two upon a passing reference which it contains to an article which appeared some time ago in our own pages on the discovery of the new planet. Speaking of the "historical notice" of the planet, read to the Astronomical Society by the Astronomer Royal, in November last, Mr. Sheepshanks says:—"No one has called in question the accuracy of any part of the statement made by the Astronomer Royal." But he adds, in a note:

"I am reminded of a silly article in the *Mechanics' Magazine*; but I presume that to have been a hoax on the editor, and not a deliberate calumny, without a particle of proof or probability to support it."

Mr. Sheepshanks cannot certainly have himself read the article referred to; for had he done so, we feel assured that, prone as he is to the use of questionable epithets, he would not have characterized it as he has done. Severe and inculpatory it is—unjust some may deem it, (though we ourselves are not of the number)—but "silly" no one would seriously think of calling it, who had the least care about his own reputation for brains. It is distinguished, in fact, by nothing so much as the vein of strong common sense which runs through it, combined with a skill in analysis of the highest order. A "hoax," forsooth! May we be often the dupes of such hoaxes! And may there never be wanting men capable of making such experiments on editorial credulity! But, according to Mr. Sheepshanks, it is even more than "silly"—it is all "a deliberate calumny, without a particle of proof or probability to support it." What the reverend gentleman means by this, we are at a loss to understand. The author of the article stated nothing on his own authority—coined nothing out of his own fancy; he but deduced certain inferences and conclusions from the statements of others. He did not, any more than other people, "call in question the accuracy of any part of the statements made by the Astronomer Royal." But this he did contend for, as he was perfectly entitled to do, that, according to the Astronomer Royal's own statement, he did not extend to Mr. Adams that prompt encouragement and protection, which it was his bounden duty to have done as the head of that department of the public service which takes the interests of astronomy under its charge; and that, but for the indifference and neglect of the Astronomer Royal, Adams would in all probability have been recognized by the world as the sole discoverer of the planet, long before the name of Le Verrier was ever heard of. Erroneous these deductions from the known facts of the case may possibly be, but "calumny" in them there is none. Let us add, too, in justice to "Exoniensis," the able writer of the article in question, that, in or out of the Astronomical Society (certainly we won't except the Rev. R. Sheepshanks), there exists not an individual to whose nature "calumny" is more utterly foreign, or who would more regret doing an injustice to another.

The language used by Mr. Sheepshanks in regard to "Exoniensis" is the more inexcusable, that it so happens that they are both of a side, on the main question involved in these discussions; and that no one, to this day, has upheld the claims of Mr. Adams so well as "Exoniensis" has done. We quote, with much pleasure, the following paragraph from Mr. Sheepshanks' pamphlet:—

"If the proof that Mr. Adams had detected the existence and place of a planet exterior to *Uranus*, as early as October 1845, be considered sufficient, and if the discovery of the new planet be understood to be the

* A motion was made for granting it to Le Verrier, and passed by a majority; but as the majority did not amount to three to one, as required by the laws of the society, the motion came to nothing.

detection of its place, mass, and orbit, by solving the inverse problem of its perturbation, and finding the planet by its effects on *Uranus*, then I think *it would* BE DIFFICULT TO DENY MR. ADAMS *the title of* FIRST DISCOVERER."

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 456.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

The improvements (Watt's) are applicable to the improved steam-engines of the specifier's invention, the whole property wherein was secured to the specifier, by patent of Jan. 5, 9 Geo. 3, confirmed by Act of Parliament passed 15 Geo. 3, and other patents of Oct. 25, and March 12, 22 Geo. 3. Cl. R., 24 Geo. 3, p. 16, No. 11. April 28, 24 Geo. 3; Aug. 24, 1784.

Robert Frost and *Thomas Frost*, of Nottingham, hosiers: of a machine and method for making figured lace and network, which may be made of any materials on an entire new principle, and which will be of particular use in that manufactory. Cl. R., 24 Geo. 3, p. 17, No. 2. July 15, 24 Geo. 3; Nov. 11, 1784.

Sutton Thomas Wood, of Oxford, brewer: of certain new improvements on the steam engine. First: The method of working steam or fire engines by means of the same coppers, pans, kettles, or boilers, as are necessarily used and employed in the carrying on and for the several purposes of trades and manufactures, so as to cause the various operations of grinding, &c., and every other operation, which may be required by the various trades and manufactures, in which coppers or boilers are used or employed, and which are generally performed by men or horses, water or wind, to be effected by the power of steam or fire engines without any extra consumption of fuel. Secondly: The method of working steam engines by means of applying separate and detached coppers or boilers, for the purpose of the steam engine, to the same fires or furnaces, as are used and employed in all such trades and manufactures to the carrying on and for the purposes of which coppers, pans, or boilers are necessarily required. Thirdly: The method of working steam engines as lastly set forth, but in manufactures where no coppers, pans, or boilers are necessarily required. Fourthly: The method of generating or increasing the quantity of force of steam for the use of steam engines by mechanical operations (*i. e.*, circulating the water in the boiler). Fifthly: The application of steam engines to the raising of ballast, &c., &c. Sixthly: The application of steam engines to all ships, &c., to answer every purpose of rowing, pushing, punting, towing, hauling, or navigating without the labour of men or horses, or the assistance of wind, current, or tide. Seventhly: The application of the water produced by the condensed steam, and which flows from the steam engine, to the various purposes of cleansing and scalding utensils in breweries, &c. Eighthly: The construction or application of the steam valve, or of that valve which admits the steam from the copper to the cylinder or condenser. Ninthly: The method of causing the perpendicular or vibrating motion of the steam or fire engine to produce a rotative motion. Cl. R., 24 Geo. 3, p. 19, No. 4. August 20, 24 Geo. 3; Dec. 18, 1784.

Robert Lydford, of New Sarum (Wilts), cabinet maker: of an invention of a pipe box conically fluted, for all sorts and sizes of wheel carriages, by which they will run a thousand miles or more with once greasing, whereby the friction is reduced, the draught lessened, the axle tree is prevented from wearing, &c., &c. Cl. R, 24 Geo. 3, p. 22, No. 6. May 19, 24 Geo. 3; Sept. 18, 24 Geo. 3, 1784.

Henry Richards, of Ditchingham (Norfolk), linen manufacturer: of a new machine for the purpose of spinning and reeling wool, hemp, flax, cotton, silk, and mohair. Cl. R., 25 Geo. 3, p. 1, No. 21. Sept. 11, 24 Geo. 3; January 8, 1785.

Robert Ransome, of Norwich, iron founder: of a new invented art of making ploughshares of cast iron, which is tempered after a peculiar manner so as to stand the strictest proof. Cl. R., 25 Geo. 3, p. 1, No. 1. March 18, 1785; April 1, 25 Geo. 3, 1785.

James Frost, of Norwich, architect: of a new invented machine or movement producing an alternate progressive and retrograde motion by a continual rotation. Cl. R., 25 Geo. 3, p. 4, No. 20. May 9, 25 Geo. 3; May 21, 25 Geo. 3, 1784.

Robert Hinton, of Preston, flour merchant: of certain improvements in windmills, consisting of a method of furling the cloth which is made use of upon the sails, either when the mill is or is not at work, of raising and falling the acting millstones in the mill, so as to cause them to grind to much greater advantage by the motion of the mill, accordant to the different force

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and pressure of the wind upon the sails thereof, and a regulating nut or wheel for turning the stones so as to cause the mill to work in a more uniform manner than by any other method hitherto used or known. Cl. R., 25 Geo. 3, p. 4, No. 11. June 11, 25 Geo. 3; July 4, 25 Geo. 3, 1785.

Joseph Hateley, of Dudley, engineer: of a new invented rotary and reciprocal [steam] engine. Cl. R., 25 Geo. 3, p. 5, No. 9. August 3, 25 Geo. 3; Aug. 8, 25 Geo. 3, 1785.

Robert Sutcliff, of Sheffield, cutler: of a dye of a new construction for stamping and ornamenting the hafts or handles of knives and forks made of silver, silver plate, or other metal. Cl. R., 25 Geo. 3, p. 8, No. 4. Nov. 7 instant; Nov. 23, 1785, 26 Geo. 3.

William Darby, of Sheffield, silversmith: of a new method of manufacturing of spoons and other articles. (By stamping, &c., &c.) Cl. R., 25 Geo. 3, p. 8, No. 2. Nov. 10, 26 Geo. 3; Dec. 6, 1785.

Philip le Brocq, of Lymington (Southampton), clerk: of certain new methods of rearing, training, cultivating, and bringing to perfection all kinds of fruit-bearing trees, shrubs and plants, vines, pines, melons, and cucumbers, and all sorts of culinary and esculent plants, whether indigenous or exotic, and all kinds of trees, shrubs, plants, and flowers in general, which require an accumulated and artificially increased degree of the natural heat of the sun to bring them to maturity or to hasten their growth; and also certain methods of defending and protecting their blossoms, fruit, &c., from cold winds, and all noxious influences of the air, and from vermin and insects of all kinds. Cl. R., 25 Geo. 3, p. 9, No. 3. Dec. 5, 26 Geo. 3; Dec. 20, 1785, 26 Geo. 3.

William Stable, of the Strand, glover and undertaker: of a new method of making every sort of gloves on a new principle, and for applying to them a new way to fasten them so as to sit close at the wrist, and for altering and applying the invention to ready made gloves of every denomination. Cl. R., 25 Geo. 3, p. 10, No. 22. Sept. 27, 24 Geo. 3; Jan. 26, 25 Geo. 3, 1785.

James Edwards, of Pall-mall, bookseller: of an invention of embellishing books bound in vellum, by making drawings on the vellum which are not liable to be defaced but by destroying the vellum itself. Cl. R., 25 Geo. 3, p. 10, No. 16. Jan. 28, 25 Geo. 3; Feb. 19, 25 Geo. 3, 1785.

George Hall, of the Strand, gold buckle maker: of a great improvement in the construction of chapes for shoe and other buckles, which are better adapted for the same than any now in use. Cl. R., 25 Geo. 3, p. 10, No. 10. Nov. 29, 25 Geo. 3; March 23, 25 Geo. 3, 1785.

James Tate, of Mill-street, Hanover-square, (Middlesex,) brazier and ironmonger: of an invention for candlesticks and nozels for sconces, chandeliers, girandoles, and other things used for holding candles, which will receive, keep upright, and hold fast candles of every size, without the trouble of paring, or the addition of paper, and without damaging the candles, either in putting in or taking out. Cl. R., 25 Geo. III., p. 10, No. 9. Feb. 26, 25 Geo. 3; March 24, 1785.

William Playfair, of Howland-street, Saint Pancras, manufacturer: of certain new methods of making shoe, knee, stock, and other buckles of silver, or other metals, and of covering the surfaces of copper or other metals with silver, gold, or mixtures of silver or gold, with other metals, which operation is commonly called plating. Cl. R., 25 Geo. 3, p. 10, No. 8. Feb. 26, 25 Geo. 3; March 26, 1785.

James Edgell, of Frome Selwood (Somerset), Gent.: of a new-invented axle or centre pin, proper and fit for the wheels of coaches, chaises, wagons, &c., which axles or centre pins are so constructed, affixed, and supported, as greatly to reduce and lessen the friction thereon, they being made much smaller in the parts producing friction, than any axles hitherto used for wheel carriages, and yet are fixed and supported in such manner as to preserve equal or greater strength and security from breaking or danger than the axles now in use, by means whereof carriages will be drawn with much greater ease to the horses drawing the same than by any method hitherto found out. Cl. R., 25 Geo. 3, p. 10, No. 1. Jan. 12, 1785, 25 Geo. 3; April 23, 25 Geo. 3, 1785.

Christopher Gullett, of Exeter, Esq.: of a new invented "Eolian Engine" for working pumps, mills, ginns, whyms, cranes, or other machines, by the force and action of the wind and the power of condensed air. Cl. R., 25 Geo. 3, p. 11, No. 12. Jan. 15, 25 Geo. 3; May 7, 25 Geo. 3, 1785.

Thomas de la Mayne, of Charlotte-street, Rathbone-place, gent.: of a new invented art of making buttons of burnt earth or porcelain [which also are formed with pierced shoulders and shanks, all of one solid body and construction, without requiring the addition of box, ivory, or other moulds or shanks for fastening the same]. Cl. R., 25 Geo. 3, p. 11, No. 10. May 3, 25 Geo. 3; May 26, 1785.

Nathaniel Godbold, of Bloomsbury-square, gent.: of an invention for the cure of consumption and disease in the lungs, called (by the Specifier) "Godbold's Vegetable Balsam." Cl. R., 25 Geo. 3, p. 11, No. 8. May 3, 25 Geo. 3; May 27, 1785.

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James Phillips, of Mortlake, ironmonger: of an invention of a new kind of stove for coppers, furnaces, malt-houses, and all other places and manufactories where that species of stoves or fire places, commonly called copper holes or stoke holes, are made use of, which will not be liable to be out of repair, but is infinitely more durable than any now in use, and has the peculiar advantage of saving fuel, time, and labour. Cl. R., 25 Geo. 3, p. 11, No. 6. May 3, 25 Geo. 3; May 30, 1785.

Anne Morse, wife of Edward Morse, of London, gent.: for an invention of a sandal clog. Cl. R., 25 Geo. 3, p. 11, No. 2. May 13, 25 Geo. 3; June 9, 1785.

Joseph Bramah, of Piccadilly, engine-maker: of an hydrostatical machine and boiler upon a new construction. Cl. R., 25 Geo. 3, p. 11, No. 1. May 9, 25 Geo. 3; June 9, 1785.

Thomas Waldron, of Catharine-street, Westminster, upholder: of a new invented art of making bedsteads, by putting them together without screws and nuts, and effectually preventing vermin from harbouring in them. Cl. R., 25 Geo. 3, p. 12, No. 9. June 4, 1785; June 27, 1785.

Thomas Lewis, of Ludgate, London, jeweller and hardwareman: of an invention of a truss on an entire new principle for the cure of ruptures of all kinds. Cl. R., 25 Geo. 3, p. 13, No. 4. July 16, 25 Geo. 3; August 15, 1785.

Thomas Dawes, of Dean-street, Soho, upholder: of an invention of a sun shade for the outside of windows. Cl. R., 25 Geo. 3, p. 13, No. 3. July 16, 25 Geo. 3; August 13, 1785.

John Poulain, of Mortlake, gent.: of an invention of a new composition of tinning or lining of all utensils or vessels made of copper, brass, iron, or other metals, especially those used for kitchen or culinary purposes. Cl. R., 25 Geo. 3, p. 15, No. 25. Sept. 13, 25 Geo. 3; Oct. 6, 1785.

Colin Mackenzie, of King-street, Westminster, smith and bell hanger: of an entirely new alarm clatterer, to prevent house-breaking, the manner of fixing which is entirely new, and is so constructed as to make a noise to alarm the people in the house, and also in the street adjacent. Cl. R., 25 Geo. 3, p. 15, No. 13. Oct. 19 last; Nov. 17, 26 Geo. 3, 1785.

Richard Potter, of Pemberton-row, London, musical wind instrument maker; of an improvement upon the musical instrument, commonly called the German Flute, and also, as to part thereof, applicable to, and an improvement upon, most of such other musical wind instruments as are played upon with keys. Cl. R., 25 Geo. 3, p. 15, No. 10. Oct. 28, 26 Geo. 3; Nov. 26, 26 Geo. 3, 1785.

John Rothwell, of Shadwell, gent.: of a great improvement in the construction and principles of valve water-cocks. Cl. R., 25 Geo. 3, p. 15, No. 9. Nov. 19, 26 Geo. 3; Nov. 28, 1785.

Lionel Lukin, of Long Acre, coach-maker: of an improvement in the construction of boats and small vessels for either sailing or rowing, which will neither overset in violent gales, nor sudden gusts of wind, nor sink if they should by any accident be filled with water. Cl. R., 25 Geo. 3, p. 15, No. 8. Nov. 2, 26 Geo. 3; Dec. 1, 26 Geo. 3, 1785.

James Tate, of Mill-street, Hanover-square, ironmonger: of a new invented cock or valve for all sorts of vessels. Cl. R., 25 Geo, 3, p. 15, No. 7. Nov. 2, 26 Geo. 3; Dec. 1, 26 Geo. 3, 1785.

Joseph Willis, of Cary-street, London, shoemaker, and *William Saunders*, of Gloucester, currier: of a new method of dressing and preparing leather with turned feet for boots, half-boots, and spatterdashes, or gaiters, and making boots, &c., for men and women without any seam in the instep, by which means the foot will slide more easily in, and they will fit and turn water better than those now in use; and also of preparing leather for shoes, and making shoes without any heel or side seam, which will likewise wear better and sit neater than those now in use. Cl. R., 25 Geo. 3, p. 15, No. 6. Nov. 3, 26 Geo. 3; Nov. 25, 1785.

John Skeys, member of the British Factory of Lisbon: of a discovery of a pump on a new construction. (Being a communication from a foreigner.) Cl. R., 25 Geo. 3, p. 15, No. 2. Nov. 7, 26 Geo. 3; Dec. 7, 1785.

John Stedman, of Soho, jeweller: of an invention of new sympathetic hinges and quadrants for folding doors, gates, and shutters, with new-invented fastenings for the same. Cl. R., 25 Geo. 3, p. 15, No. 1. Nov. 17, 26 Geo. 3; Dec. 14, 1785.

Sutton Thomas Wood, of Oxford, brewer: of certain new discoveries in the application of steam; and also certain methods of using the water produced from condensed steam; and for applying the water from the coppers or boilers of steam engines to other purposes than that of working the steam engine; and also various methods of heating and applying water for the several purposes of the breweries and distilleries, and for forwarding the process of brewing; and also certain methods of constructing and adapting coppers, boilers, tubes, and other hollow bodies, for the more effectual means of heating water and worts, and of rendering such coppers,

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&c., as are employed in the breweries and distilleries steam and air-tight.

The application of steam described by the specifier are various; and reference is made to the specification enrolled pursuant to patent granted to the said *Sutton Thomas Wood*, August 20, 1784. Cl. R., 25 Geo. 3, p. 18, No. 11. Nov. 17, 25 Geo. 3; March 15, 25 Geo. 3, 1785.

James Watt, of Birmingham, engineer: of certain newly-improved methods of constructing furnaces or fire-places for heating, boiling, or evaporating of water and other liquids, which are applicable to steam-engines and other purposes; and also for heating, melting, and smelting of metals and their ores, whereby greater effects are produced from the fuel, and the smoke is in a great measure prevented or consumed. Cl. R., 25 Geo. 3, p. 20, No. 11. June 14, 25 Geo. 3; July 8, 1785.

Sutton Thomas Wood, of Oxford, brewer: of an invention for distilling, rectifying, refining, and preparing spirits, oils, sugars, and salts, and other substances and solutions, by the power and application of steam, and certain discoveries in the application of steam to the carrying on, and to the various purposes of, trade and manufactures. Cl. R., 25 Geo. 3, p. 21, No. 16. July 27, 25 Geo. 3; August 27, 25 Geo. 3, 1785.

James Alston, of Birmingham, buckle and button-maker: of an invention of lining, edging, plating, and covering either in the whole or in part, with silver or gold, or otherwise, buckles and other articles made of iron, copper, or other metals, or mixed metals, by the use and application of tin, or alloyed tin. The improvements in this specification consist, 1stly, In the method of giving and preserving a durable covering of tin, silver, or gold on the edges and bottoms of buckles of iron, or other metals plated with silver or gold, by means of tin solder, by which the present objections to buckles of that description are obviated. 2ndly, Methods of covering or inlaying buckles of the above description with silver and gold, or otherwise, in any suitable form or devise; and also plating spoons, spurs, and table forks with a durable coat of tin and silver. 3rdly. Methods of giving complete impressions by means of a roller, or rolling press, to the plates of silver and gold previous to their being fixed on the buckle. 4thly. Methods of covering with tin, silver, gold, or other metal, buttons made of iron and cast-iron. Cl. R., 25 Geo. 3, p. 22, No. 2. Nov. 19, 26 Geo. 3; Dec. 17, 1785.

John Martin, of Southampton, wine merchant: of a roasting-jack with pulleys, and other appurtenances, on a new construction, called (by the specifier) a "Tourne Broche." Cl. R., 25 Geo. 3, p. 24, No. 10. Feb. 18, 25 Geo. 3; June 10, 1785.

Robert Berriman, of Speen, (Berks,) wheelwright: of an entire new apparatus for the purpose of supplying carriage and all other kinds of wheels with grease without taking them from the axle, and whereby they will be enabled to run considerably longer without fresh greasing than by any other method hitherto practised. Cl. R., 25 Geo. 3, p. 26, No. 6. Nov. 10, 26 Geo. 3; Nov. 18, 1785.

John Morris, of Greenwich, carpenter: of new invented window shutters of wood, ron, tin, and other materials, to slide up and down, and thereby regulate and shade the light, and shut up and blind the windows, and which are particularly calculated for taking up little room. Cl. R., 25 Geo. 3, p. 26, No. 1. Oct. 28, 26 Geo. 3; Nov. 28, 1785, 26 Geo. 3.

John Pennington, of Liverpool, china-manufacturer: of a new and peculiar engine or machine, whereby any given number of pumps, sledge-hammers, or other subjects, requiring the like powers, may be wrought with facility, ease, and expedition, at a small expense. Cl. R., 26 Geo, 3, p. 1, No. 18. Dec. 19, 26 Geo. 3; Jan. 14, 1786.

John Bull, of Worcester, glover: of a machine for the purpose of paring, pumming, friezing, and grounding of leather, used in the manufacturing of gloves, breeches, and shoes, and for binding of books, and for cutting out of shoes, slippers, gloves, mitts, and muffs, and for embellishing the same with ornaments in gold, silver, and colours. Cl. R., 26 Geo. 3, p. 1, No. 1. Jan. 31, 26 Geo. 3; Feb. 28, 1786.

Paul Higton, of Shrewsbury, flax-dresser: of an entire new machine, or machines, for spinning and roving sheep's and lambs' wool for the purpose of making cloth, or any and every other purpose wherein woollen yarn is used, in a much cheaper and more expeditious manner than any hitherto used, and which may be worked by water, horse, &c. Cl. R., 26 Geo. 3, p. 2, No. 14. Feb. 21, 26 Geo. 3; March 13, 1716.

Griffith James Cheese, of Manchester, organist: of a musical instrument upon an entire new construction, called (by the specifier) "The Grand Harmonica," combining the powers of several other instruments, and which has the peculiar advantage of always keeping in tune. Cl. R., 26 Geo. 3; p. 2, No. 8. March 11, 26 Geo. 3; April 10, 1786.

John Royds, of Falinge, Rochdale, merchant: of new invented engines, or machines, for the purpose of roving, slubbing, and spinning of woollen, worsted, and

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linen yarn, in a manner not heretofore practised, by means of which the roving, slubbing, and spinning may be executed in a much better manner than by any other means hitherto discovered. Cl. R., 26 Geo. 3, p. 7, No. 8. Oct. 18, last; Nov. 9, 1786.

George Winter, of Charlton, Gloucester, Gent.: of a machine for the purpose of depositing or drilling the seed of every species of vegetables in a manner entirely new, and more expeditious and regular than heretofore known, and which requires a less quantity of seed to produce a large cro han is necessary by the common mode of casting, whereby a considerable saving will be effected, and which machine possesses the peculiar quality of being regulated with ease, so as to increase or decrease the quantity of seed sown at the discretion of the seedsman. Cl. R,, 26 Geo. 3, p. 7, No. 7. Oct. 18, 26 Geo. 3; Nov. 9, 1786.

(*To be continued.*)

LIST OF ENGLISH PATENTS GRANTED FROM MAY 7 TO MAY 10, 1847.

Isham Baggs, of Holford-street, Holford-square, Pentonville, Middlesex, for certain improvements in the production of artificial light. May 7; six months.

Joshua Fielden, of Waterside, Todmorden, Lancashire, Esq., for an improved mode of laying and pressing cotton, silk, wool, flax, and other fibrous matters into cans, baskets, boxes, or other depositories. May 8; six months.

Amos Bryant, of Heavitree, Devonshire, gardener, and Richard Tothill, of the same place, surgeon, for improvements in preparing, constructing, and draining land, and an improved implement or implements to be used therein. May 8; six months.

William Norman, of Paradise-place, Finsbury, Middlesex, cabinet maker, for improvements in the construction of expanding or dining tables. May 10; six months.

John Martin, K. L., of Allsop's-terrace, Middlesex, for improvements in apparatus and means used when draining cities, towns, and other inhabited places and land. May 10; six months.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
May 6	1057	Charles Chapman Clark	Hammersmith, London, and Reading, Berks	Valve for preventing escape of effluvia from drains.
7	1058	Andrew Lamb & John White	Southampton	Sea-going life-boat.
,,	1059	James Balthazar Ziegler	26, Gillingham-street, Pimlico	Valve perfecting slide for cornets, &c.
8	1060	Thomas Bullock	Cliveland-street, Birmingham	Shank for buttons.
10	1061	Peter Esdaile Bearblock	Hornchurch	The small farmers' Hornchurch hand-sowing machine.
11	1062	George Harwood	Ipswich	Ventilator.
13	1063	Henn and Slater	Birmingham	Spring for runners for umbrellas and parasols.

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London, March 3, 1847.

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The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1241.] SATURDAY, MAY 22. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

CLAASEN'S IMPROVEMENTS IN RAILWAYS AND RAILWAY CARRIAGES

Fig. 1.

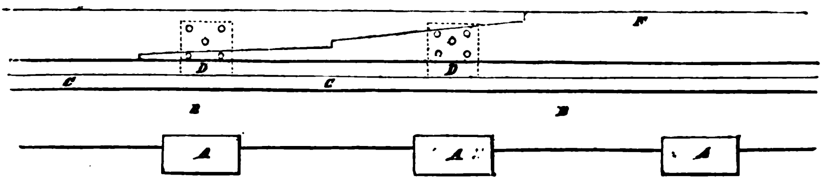


Fig. 2.

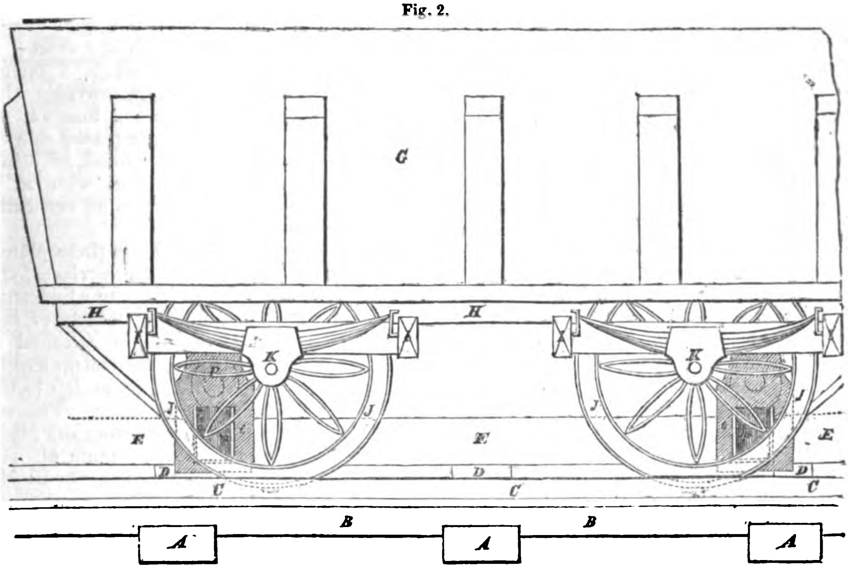
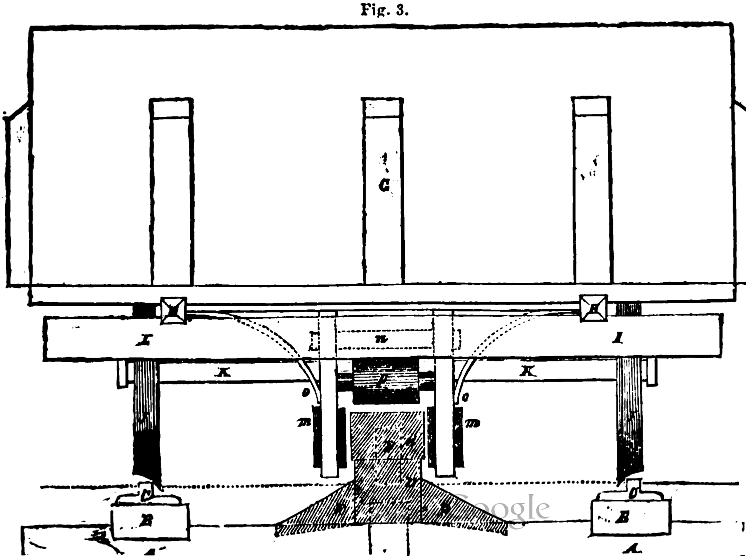


Fig. 3.



MR. CLAASEN'S IMPROVEMENTS IN RAILWAYS AND RAILWAY CARRIAGES.

[Patented in England by Mr. J. C. Robertson on behalf of the Inventor, Mr. P. C. Claasen, of Amsterdam.]

The object which Mr. Claasen has proposed to himself in the railway improvements which form the subject of this patent is, to make it next to impossible for any serious harm to arise from either the breaking of axles, or the running of carriages off rails — two of the most frequent causes of accidents, as railways and railway vehicles are now constructed.

With this view he places in the centre of each line of railway a centre rail, much more elevated than the two side-rails, and attaches to the bottom of each of the carriages one, two, or more, triple sets of rollers, one of which is placed horizontally so as to come in contact with, and run on the top of the centre rail, in the event of an axle breaking, while the two other rollers are placed vertically one on each side of the centre rail, to prevent the carriage from swerving to either side. These rollers run always free of the centre rail except when any accident occurs, or the making of a sharp curve brings them into action. The number of sets attached to each carriage varies with the length of such carriage.

Figure 1 is a side view showing the elevated centre rail before referred to, which may be made of wood or any other convenient material.

Figure 2 is a side view of the lower part of a wagon, with the additional wheels applied to it; and fig. 3 a front view of a line of railway with a wagon advancing upon it, showing at one view the whole of the arrangements.

The rails are represented in these figures as resting on plain longitudinal beams, whereby the chairs usually in use are dispensed with; but the inventor desires it to be understood that his invention is equally applicable to all railroads, whatever may be the description of beams made use of.

In fig. 1 A represents the sleepers; B B the longitudinal beams which carry the rails; C the rails; D the block which supports the centre rail; E the centre-rail which may be of wood, iron, or other suitable material.

In figs. 2 and 3, A A are the sleepers; B the longitudinal beams; C the rail; D the block placed on the sleepers to support the centre rail; E the centre-rail; F F (in dotted lines) mortises and tenons of wood, or iron, one uniting the block D to the sleepers, and the other the top rail E to the block D; E* E* are two triangular blocks, or stays, let into the sleepers as indicated by the dotted lines; G the body of the wagon; H the longitudinal timbers on which the wagon is supported; I I the cross-pieces; J the wheels; K the axles; *l l* are two plates of iron about 3 inches thick, and 12 inches deep, provided with square openings 10 inches long and 6½ inches broad, in which are placed rollers, *m m*, of metal, or hard wood, of 6 ins diameter and 9½ ins. long, with axles accurately turned and running vertically in brasses.

The mode of attaching these plates, *l l*, to the bottoms of the carriages, the exact part of the carriages to which they should be fixed, and the number of sets of rollers which should be attached to each carriage, will all depend on the length of the carriages, and must be left to the judgment of the constructor. The inventor himself prefers placing the plates near the axles; *n* is a plate of iron which passes through openings in the plates *l l*, and being united thereto add materially to their strength. O O are strong iron stays, for which in some cases strong iron straps may be substituted.

Between the iron plates *l l*, another horizontal roller, *p*, of iron, or other suitable material is placed, 8 ins. diameter and 12 ins. long; this roller is very accurately turned, and has its bearings in brasses placed in the sides of the plates, as indicated in the engravings by dotted lines. Q Q are bars which connect longitudinally the plates *l l* (see fig. 2), and are flush therewith.

The centre rail is constructed in the following manner: Blocks of wood, D (fig. 3), are placed in the centre of the sleepers of about 10 ins. in thickness, and 12 ins. in breadth, and firmly united thereto by means of bolts, or mortise and tenon joints, supported on each side by blocks of wood, F*, of a triangular shape let into the sleepers and bolted thereto.

On the block D is placed the longi-

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tudinal beam, or centre rail E, about 8 ins. in thickness and 12 ins. in breadth. The pieces of timber chosen to construct this rail should be as long as possible, and when two ends are united, as shown in fig. 1, the supporting blocks may be placed on two sleepers next each other, whereas in other cases they need only be placed on every other sleeper. The centre rail must be united to the block D, as well as the blocks D to the sleepers A, by means of mortises, as shown at E, and marked in dotted lines, or by means of iron bolts, so that the whole may become one immovable mass.

Although the centre rail is described as being made of wood, it is to be understood that the inventor does not limit himself to that material, for it may be made also of iron, when the dimensions would require to be somewhat modified in proportion to the difference in strength between the two materials. The inventor also reserves to himself, the right to make the rollers of any materials that may be found suitable for the purpose, and to vary the relative proportions of the different parts as circumstances may determine.

From what has been stated, it will be readily understood that on the breaking of an axle the centre-roller, *p*, will run on the centre-rail and support the carriage, and that in the event of any obstructions or accidents occurring on the road, it is impossible that the carriages should deviate from their proper course, being maintained in their positions by the rollers *m m*. The carriages will be also enabled by these contrivances to run safely round sharp curves without danger, as the side rollers would bear against the centre rail and keep the train from running out of its course.

It may be further observed that by the adoption of this invention, railway engineers will be enabled to reduce considerably the large sums now ordinarily expended in securing safe curves and easy gradients; and that locomotives, tenders, and passenger-carriages may all be made of much less weight and strength than at present.*

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* A model of this invention on a considerable scale, may be inspected by any gentleman desirous of further information respecting it, on application to Mr. Claasen, No. 21, Norfolk-street, Strand.

THE "COLLEGE OF PRECEPTORS."

(Continued from page 446.)

There is nothing particularly new in the complaints of professional incompetency amongst rival schoolmasters; and perhaps in the great majority of cases, their mutual recriminations have more of truth in them than the defences against the charge. Still there are, and there always have been, bright exceptions to the truth of such; and though they be relatively but a small section of the entire class, they have been sufficiently numerous to render wholesale condemnation most unjust. Such men have not, however, always been those most "patronized" by the public, nor yet the most bustling of the schoolmaster-class to gain public notoriety. Something, too, must be allowed for the fact, that such men are somewhat liable to aim too high for the *wants* of cotemporary society. It does not follow, indeed, that the most profound scholar is, *of necessity*, the best elementary teacher of science or of literature; and, indeed, except he have devoted much more of his attention to the *art of tuition* than men of eminent acquirements generally do, he may even be a less efficient teacher than men of humbler acquirements, who have given due attention to the rationale of instruction.

However, as far as we have seen in life, parents who have sent their sons to school, have *usually* taken into consideration the reputed ability of the master, conjointly with the reputed rapidity of improvement of his pupils. Parents may not have been adequate judges of the solidity of the knowledge acquired by their children, or even of its real value. They might have deemed fine calligraphy, the ready manipulation of "a sum," or the fluent utterance of a few scraps of Latin and Greek, as superior learning: they might even undervalue logic, mathematics, and natural philosophy, so far as to despise them—yet parents have always "patronized" that master who had a reputation for *teaching well* those branches of education which they wished their sons to acquire. That there has been much impudent pretension to superiority made by men who were of inferior acquirements, there can be no doubt; and that the man of real science or real literature should suffer, from his declining to urge, with gross self-laudation, his own supe-

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rior claims, is equally evident. The fault is in *parental ignorance;* but still *parental motive* is pure. When parents shall become capable of judging for themselves of their children's progress in learning, the charlatanism of the mere pretender will die away of itself.

We have often heard very learned schoolmasters complain of the neglect with which they were treated. That very neglect, however, we could generally trace to one of these causes: their inability to give attractive publicity to their superior claims,—a too stately and rigorous mode of instruction, which failed to arrest the pupils' attention,—a dislike, and consequent inattention, to the humbler subjects they professed to teach,—the competition of other men, whose claims, from some accident, happened to have obtained a more public and general recognition,—or that they were settled down in a locality where learning like theirs was not a desideratum. Such men are objects of our warmest sympathy. Still, generally, *they* are not the men who have engaged in organizing a "College of Preceptors." They complain, it is true; but they are too few to organize, and too sore to aggregate. The *active men* in this organization are not men of a high intellectual order; they are nearly all alike undistinguished by works which bespeak either genius or acquirements; and the very highest of them, as regards scholastic importance, are more to be noted for their positions in some of the joint-stock schools (or it may be, now and then, an endowed grammar-school), than for the qualities that ought to characterize the scholastic dictator. That a few have joined the "College," from an approbation of the *principle of the movement*, we know; that many more *would have done so*, but for the absurdities which its early leading members have perpetrated, we also know. We know yet more—that if the ridiculous pretensions set up by this association be longer continued, the few men, whose names reflect credit upon the movement, will speedily withdraw from the "College."

The population of Brighton, like that of mere watering places, is composed chiefly of retail traders and lodging-house keepers, with a few professional men, and noble or gentle "birds of passage." A "proprietary school" was of course established during the mania, chiefly by the trading class, with a spare sprinkling of the professional. A great number of private schools, adapted to London tradesmens' sons, were also established—the houses having "fine names" (after the fashion of suburban Cockaigne), and their masters "wide-awake men of the world," with a modicum of learning, and an abundant share of "easy assurance." For the most part, these schools have been *commercial* ones, seasoned with the usual "accomplishments," under the names of Classics, Drawing, French, and Dancing, but essentially devoted to training boys for the counting-house.

That the "commercial schoolmaster" is a very important element of our social system, there is no question: for it is a commercial education alone which forms the essential qualification of the commercial part of our population for their daily routine of duties. That intellectual powers may be introduced into commercial knowledge is also equally obvious; but that high powers of mind are often found in this class of men is contrary to our own observation and experience: and as a general statement we feel no difficulty in expressing our entire dissent from the dogma. There is not sufficient room afforded for *educating* the mind by the objects that can be brought under the name of "commercial," and which are really within the comprehension of boys under fourteen or fifteen—the usual age at which such boys leave school; and the *master*, whose acquirements are only of this limited character, must be sadly wanting in all the higher qualities of a teacher. But even in strictly commercial matters, few of them are quite "at home:" for it is very rarely that any one of them can give an intelligible analysis of the "ledger," &c., or design the details of a system of "book keeping" adapted to the peculiar exigencies of any extended business whatever. So rare, indeed, is it, that we have many times made the experiment of getting an intelligible theory of book-keeping from commercial masters who had been successful in their schools, and yet never found a single exception to the truth of our remark taken in its most sweeping generality. Such men are mere men of routine: they remember what they themselves were trained to *believe;* they are become expert by

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constant practice in the "rules for calculation;" and they teach, as they themselves were taught,—by rote.

It is a matter of every-day experience that the man of few ideas is always a vain man; or, in vulgar phraseology, "as proud as a hen with one chick." Nothing has such beneficial influence in the cure of a man's vanity as extending his actual knowledge. He gradually acquires a conviction, as he proceeds in the career of inquiry, that his own amount of learning is growing less and less in comparison with the boundless vista of truths that lie open before him. To this state our commercial schoolmaster never arrives: but he is fully satisfied with "chuckling over his one chick" as the *rara avis* of his enchanted region of mind.

Yet it is of this class of schoolmasters that the "College of Preceptors" is *mainly* composed! Nay, the majority of those who founded it are of the same class; and from this class the great bulk of its present members (its "original members" *by virtue* of their having paid one guinea each before the 1st day of 1847!) are embodied in the "College," and ornamented with a tail having the form, "M. C. P." In imitation of other great societies, this will, probably, another year be transformed into "F. C. P."

We really thought well of the *principle* of this movement: nay, we do so still. It is with sincere pain therefore that we find it put wholly out of our power to aid the scheme,—an aid which we were disposed to give with heart, and hand, and pen. There are men of tact and business-talent engaged in it, it is true: but we fear (from all we have seen of their views as put forth in pamphlets, printed and written letters, resolutions, and the "Calendar"), that their peculiar "council-talent" is better adapted to the organization of a *commercial company* than of an *educational institute.* They write magniloquently, and with the most reckless defiance of all opposition: but by courting opposition, and provoking hostility by their assumption, they show that they are wanting in the better part of valour,—they lack discretion. No undertaking, however pure the motives of its projectors, or however patriotic and beneficial the scheme, ever yet succeeded in which the essential quality of discretion was not the governing principle of its councils. Is the "College of Preceptors" to be the first and solitary exception? This body (if its ulterior objects are those which are publicly proposed—*which we doubt*) aims at too much, and assumes too much. It has vitiated its proposed fundamental principle, of giving a more select and elevated character to the members of the scholastic profession, by its indiscriminate enrolment of *all* who chose to apply and to *pay* within a given time, without the slightest inquiry into their talents, character, or professional competency. This we consider to be its fundamental error; an error committed for the paltry consideration of the funds it could thereby raise. Such a scheme would have been correct for a railroad; but *education* is not to be subserved by a subscribed and paid up capital. Money is the proper qualification for monetary undertakings: but is the payment of a guinea a proper criterion of a schoolmaster's ability to teach? The scheme, therefore, has been so worked as to embody in the elementary composition of the college, the virus of the malady (aye, in its most virulent form), which it was the *professed* object of its founders to eradicate from our social institutions! "A little leaven leaveneth the whole lump;" but here almost the "whole lump" is "leaven" itself.

Again, it is only by the *votes of these men* that the most eminent, literary, or scientific person can become enrolled amongst the "College of Preceptors!" The college appears to us to have thus made the most effective provisions for retaining the low standard of acquirements, that may be most advantageous to the credit of its present members. Will men of superior minds submit to such an ordeal as that of ingratiating themselves into the *elective favour* of such a constituency? Does not every child know that the dolt will exercise all his influence to prevent the intrusion of higher talent into his *own circle?* On this account we hold the *principle of action,* upon which the society has chosen to move, to be essentially vicious. Rare men, indeed, are these to sit in judgment on the highest literary or scientific men of England! It reminds one of Aristides and his ostracist. It is simply ridiculous in itself; but a fatal error as far as the success of the "College of Preceptors" is concerned. Yet this effect results from the "commercial" scheme of "raising

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funds," to which the projectors in their superlative wisdom have had recourse.

This is not all. Mr. Wharton (one of the active originators of the college), in a printed letter "to the Members of the College of Preceptors" (dated Feb. 22, 1847), gives amongst the "further results contemplated" by the college the following remarkable anticipation:—

"That *incompetent and unworthy pretenders*, NOT DARING TO OFFER THEMSELVES as members of such an association, WILL SINK INTO THEIR PROPER INSIGNIFICANCE."

So, then, all who do not choose to submit their qualifications as teachers to the judgment of this self-constituted tribunal—this clique of science, however eminent, are to be put down as incompetent and unworthy pretenders. Presumption is too mild a term for this.

It may be said that this is but the personal opinion of a single member; and true it is that Mr. Turrill (the "President" of the council) has at the close of his printed letter of the 24th ult. introduced the following caution:—

"It will be necessary for the public, in judging of the character of the college, *carefully to discriminate* between the expressions of individuals, and the resolutions of the general meetings of the council. The latter only can be legitimately regarded as proceeding from the college, and for these alone, we deem ourselves responsible to the public and the profession."

We might infer from this that the college as a body disapproved of Mr. Wharton's wild vagaries; but on turning to the "Calendar," we have found (p. 100) the same paper, and the same preposterous passage in it, adopted by the college itself *in its own official organ*. This principle is no longer, therefore, to be viewed as the peculiar crotchet of Mr. Wharton, but as the matured and published principle on which the College of Preceptors is prepared to act. They have (or the "Calendar" is a delusion) thus expressed their determination to ride down all—not opposition merely, but—all neutrality in the scholastic profession! Every one who does not join their ranks and contribute his guinea to swell their funds, is to be proclaimed to the whole world as an "incompetent and unworthy pretender." We know no language sufficiently strong in which to express our disgust and abhorrence of the undisguised tyranny of such a scheme.

We have not, however, yet arrived at the climax of their arrogant pretensions. Having enrolled the heteregeneous medley of members which appears in their "Calendar," the secretary adds to the burlesque by the following statement:—

"The principal arrangements of the College of Preceptors will now be seen to have *assumed such a consistence and formation as will warrant their applying to be incorporated by Royal charter*. THIS STEP WILL BE TAKEN as soon as the collateral institution for ladies, and the assurance department, are fully organized. Such an *incorporation*, with its attendant privileges, is absolutely necessary, that the scholastic body of this kingdom may, *in truth*, be a profession, and be equally in a recognized position as the clerical, legal, and medical professions."—*Pref.* p. vi.

All doubt of the ambitious object of bringing the whole tutorial body of England under the yoke of the Brighton pedagogues, is thus removed. They might not perhaps find the prime minister in quite so great a hurry as they are themselves; but really (with the long array of the patron-saints of education in their favour), it is not easy to say that a march might not be stolen upon us,—that we may not wake some fine morning and find "*furcifer*" written on the brows of nearly thirty thousand schoolmasters, who went to bed the night before fondly deeming themselves *free men*. "Back-stairs legislation" is not even yet gone out of fashion. It is time for the "profession" and the "press" to do their duty—to repel this preposterous aggression, and to resist these chains being riveted on their minds.

To that very extraordinary publication, the "Calendar," and to some other topics that are suggested by it, we intended to give a share of attention in our present number; but we had written thus far when a letter from Mr. Wharton himself reached us, with a copy of the *first* edition of his tract on "The Education of the Middle Classes." We shall, therefore, at the risk of some disorder in our arrangement, depart from our original plan, and give Mr. Wharton's letter at once. We lay it down as a principle, that whatever any man has to say in defence of himself and his party, should take precedence of all editorial rights of

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priority in a periodical work, especially in respect to editorial censure:—

"Sir,—I have just received a copy of the *Mechanics' Magazine* of the 8th instant, in which you attribute the origin of the College of Preceptors to the Brighton College. Now, the College of Preceptors was in actual formation three months prior to the formation of the Proprietary College at Brighton, and also its institution had been discussed for years previously. I send you a pamphlet on the subject, which was published Jan. 1, 1839, and at pages 25, 26, 27, you will find the establishment of a college similar to the present one pointedly advocated. There have been two editions since that period, but considerably altered.

Yours, &c.,

J. WHARTON.

Brighton, 14th May, 1847.

"I have been privately informed that you are offended with a remark of mine about Woolwich examinations—it ought to apply to the entrance examination, and the custom of employing some examiners who are teachers at schools around Woolwich."

We cannot for the life of us conceive why Mr. Wharton should imagine that *we* could be "offended" with any strictures which he had made on the Woolwich examinations. Good or bad, honest or dishonest, we have no direct means of ascertaining whether they be as Mr. Wharton represents them or not. If our correspondent know, and is disposed to take the responsibility of affirming what his query implies (pamphlet, page 20, second edition), and can make out his case in a satisfactory manner, we think our previous notices of that institution ought to convince him that *we* should be ready to aid him in their exposure. Such a question as "How little *honesty* is exhibited in an examination at Woolwich?" implies a great deal; and we would recommend Mr. Wharton to make sure of his ground before he answers it, as he seems inclined to do. It is not our practice to admit censures without good foundation. At all events, his postscript, given above, does not justify the indiscriminate and wholesale charge which the question we have quoted absolutely forces upon the mind of the reader. Of the statement that the "custom of employing some examiners who are teachers at schools around Woolwich," we cannot either affirm or deny the truth; although we cannot readily bring ourselves to think that, with the large professional staff employed in that establishment, such a practice is necessary, or even possible. We wait, however, such explanations as Mr. Wharton, or any other correspondent, may be pleased to supply us with. However, we do not see, that even were this the case, that the *dishonesty* of which Mr. Wharton speaks *must of necessity* ensue. Yet we should think that such a state of things, if proved to exist at all, is most unseemly, derogatory to the dignity of a public institution, and likely to be productive of serious evils in respect to the public service.

We have one question to ask of Mr. Wharton, in respect of that statement in his letter, which is contradictory to our own previous assertion at the close of the former article. Does Mr. Wharton wish it to be understood that the "College of Preceptors" was *organized three months before any movement was made towards the establishment* of the "Brighton Proprietary College?" We wish a distinct and unevasive answer to this question. Nay, was the "College of Preceptors" (or, rather, as it was originally called, the "Society of Schoolmasters") even *seriously thought of* before steps had been taken to canvass the opulent inhabitants of Brighton to combine for the formation of a new educational institution, under the name of the "Brighton Proprietary College?" We wish only a plain statement of plain facts; and if we are supplied with such a one as is consistent with what we ourselves know of the past, it will afford us satisfaction to give it our circulation, though they should justify opinions at variance with those which we had previously formed.

We have one word more to say before we close the present article. We are advocates of "fair-play," and our readers are aware that we never refuse to open our pages to the rejoinder that any person who feels himself aggrieved may wish to make—subject to the condition of its being temperate, circumstantial, and kept strictly to the points at issue. We shall, indeed, be glad if the College of Preceptors can show that we have misapprehended their motives or their wisdom; and in such case we promise

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them the most ample amends. It is with pain, indeed, that we have felt ourselves compelled by our public duty to place ourselves in a position with respect to them that we now do: for we hailed with hopeful feelings the first opening of their campaign, and were only deterred from entering into active co-operation with them from finding, that as they developed their plans, they appeared to us infinitely more mischievous than subservient to the diffusion of sound learning.

P.S. If any of our friends can furnish us with detailed particulars of the counter-movement, made, it is believed with the concurrence, or something more, of the Bishop of London, towards the close of last year, they will do us (and we believe the public) a service. We have before us a circular to the clergy, signed "Phelps John Butt, A.M., Upper Heath, Hampstead, Nov. 16, 1846." Its ostensible promoter was the notorious Archdeacon Hale Hale! It is a curious document, and we may perhaps hereafter print it entire. We forbear comment until we are put in possession of the steps and the results to which it led; if, indeed, it led to any result beyond the recent appointment of the rector and curate of St. Giles's, Cripplegate.

(*To be continued.*)

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

No. 5 (a)—SUPPLEMENTARY REMARKS—VALUES OF SYMBOLS—SYMMMETRIC PRODUCTS.

In stating, as I have done in the last of these Notes (*b*), that, in the solution of certain problems, Mr. Jerrard employs *seven* terms in the expression for y, when *six* (or even *five*) would suffice for his purpose, it must not be supposed that I allege that the additional terms are useless. It is true that, the greater the number of terms we employ, the higher are the degrees of the symmetric functions (of the roots), whose values in terms of the co-efficients of the given equation we are required to determine; but, for the rest, we gain an advantage by increasing the number of terms (*c*). The only question that remains is,—Whether such advantage be counterbalanced by any restriction which the introduction of additional terms may impose upon the application of the processes under consideration? This question suggests itself on perusing Articles [10] and [11] of Sir W. R. Hamilton's *Inquiry* (*d*), where it appears that, by assuming an expression for y consisting of *twenty-one* terms, we may take away four terms at once from equations of the *tenth* and higher degrees (*e*); while if we endeavour to simplify our operations, by avoiding (except, of course, in the solution of $D'=0$) (*f*) the introduction into our processes of equations higher than cubics, and—to this end—employ an expression for y consisting of *thirty-three* terms, the required transformation can only be effected for equations of the *eleventh*, or higher degrees (*g*). So that the validity of the result is, in certain cases, dependent upon the method of investigation which we follow (*h*). When, however, we have a number of *linear* equations to solve, and also one of a higher degree, a reference to Article [16], pages 341—342 of the *Inquiry* just cited, will show that the introduction of additional quantities, for the purpose of facilitating the solution, will not affect the final result. The employment of *seven* terms will not, then, diminish the applicability of Mr. Jerrard's processes. Nor will the use of *six*, (or *five*,) only, increase it. It is the solution of the cubic, without being involved in elevation of degree by the *quadratic*, that forms the gist of the problem.

In the higher parts of the Theory of Equations it sometimes becomes a question of the utmost importance to determine the *number of values* which any expression under consideration can take. This determination it may not be always easy to effect—nor may the means of effecting it be very obvious. And it is not impossible that, on this ground, the Arguments against the solvibility o

(*a*) No. 4 will be found *ante*, page 418.
(*b*) *Ante*, page 422, right-hand column.

(*c*) See Mr. Jerrard's *Mathematical Researches* page 93, note.
(*d*) See the *Report of the Sixth Meeting of the British Association*, pages 318—326.
(*e*) Ibid. page 322.
(*f*) The equation (17) of the *Inquiry*.
(*g*) *Sixth Report, &c.*, page 326.
(*h*) Ibid. pp. 347—8, Art. [21.] (concluding article).

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equations of the fifth and higher degrees will be found to be unsatisfactory(i). But I need not have selected so advanced a portion of science for the purpose—had such been my purpose—of illustrating the difficulties in which, even on ordinary occasions, we are frequently involved by the multiplicity of results to which the discussion of algebraical questions often conducts us. It is by no means rare for extraneous results to be introduced into the final expressions, by the very means which we adopt for arriving at it—by elimination, for instance.

This occurs sometimes to an extent almost overwhelming. But my observations will be directed to another source of error—the want of due attention to the *symbolical* meaning of our formulæ. We are under a mistake when we consider the ARITHMETICAL and the SYMBOLICAL meanings of expressions as identical or co-extensive. And this mistake may be prejudicial to the distinctness of our views respecting the solution of even purely arithmetical questions. By way of illustration, let us suppose that the two values which the expression

$$\alpha+\beta\ (s^2)^{\frac{1}{2}} \quad . \quad . \quad . \quad . \quad (1)$$

may bear are given by the formula

$$\alpha\pm\beta\ \sqrt{s^2} \quad . \quad . \quad . \quad . \quad (2),$$

or, more conveniently, by

$$\alpha+\beta\ \sqrt{(\pm 1)^2\, s^2} \quad . \quad . \quad . \quad . \quad (3);$$

then, since, *arithmetically* speaking, $(+1)^2=(-1)^2$, it might seem to be unimportant which value of (2) we took to represent (1). But since $(+1)^2$ and $(-1)^2$ are not *symbolically* identical, ($i\,i$) we ought, before assigning a value to (1), to ascertain whether $+1$ only, or -1 only, or *both* of those symbols, are comprised under the radical sign in (3); and, according to the state of the case, we must give to (1) the upper, the lower, or *both* the values of (2) respectively. So, r and s being numbers, the expression

$$\sqrt{(+1)^2\, r^2+(-1)^2\, s^2}$$

will, *symbolically* speaking, have to be taken as positive or negative, according as r is greater or less than s; and the same considerations apply in other cases. Further, although this last expression is, *arithmetically*, equivalent to

$$\sqrt{r^2+s^2},$$

yet, by bearing in mind the mode of derivation of our arithmetical formula, we may derive some assistance in actual practice. Thus, let it be required (j)

"*To divide the number* 30 *into two such parts, that their product may be equal to* eight *times their difference.*"

We have no difficulty (jj) in reducing this problem to the solution of the quadratic

$$x^2-46x=-240;$$

add the square of half the co-efficient of x to both sides of this equation, and we have

$$(x-23)^2=(-23)^2-240.$$

The right-hand side of this last equation is arithmetically equivalent to 289, (or 17^2); but, in completing the solution of the given problem, we shall, in conformity with the foregoing observations, consider it as the square of a *negative* quantity, for, in diminishing 23^2 (or 259) by 240, we do not alter the *symbolical* affection of the former number; x will consequently be equal to $23-17$, or 6. And, therefore, 6 and 24 are the parts into which 30 must be divided in order to fulfil the required conditions. Had we taken the positive value of the radical, we should have had 40 and -10 as the "parts" into which 30 would have to be divided. Now, regarded with reference to the given problem, this last solution is open to various objections. And, first, 40 cannot be said to be a "*part*" of 30 (jj), nor can -10. But, waiving this objection, as one arising from the generality of algebraic language, it is open to a second, on the ground of *ambiguity*. For, taking 50 as the difference between 40 and -10, *eight* times this difference is 400; but the product of these "parts" of 30 is -400, and the conditions of the problem are not complied with, although they would be if we considered -50 as the "difference" between -10 and 40. It is not, of course, meant to be asserted that the quadratic is in this latter case erroneously solved, or that any mistake has been made in the expression of the question in algebraical language, but

(i) Peacock's *Algebra*, concluding page of the second volume (last edition, Camb. 1845);—quoted *ante* Note 2, page 125.

($i\,i$) Peacock, *Third Report of British Association*, page 275, and also page 264.

(j) Bridge's (B). *Algebra*, Sixth Edition (London, 1826), page 97 (question 3).

(jj) *Vide* ibid.

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merely to point out that that quadratic has only one solution strictly applicable to the problem, and that the appropriate solution can be picked out by scrutinizing the symbols from whence our results are derived (k). The symbolical are more expressive than the arithmetical formulæ, and more plastic, and often bear the impress of conditions which, were those formulæ considered in their arithmetical bearing only, would be altogether extrinsic and collateral.

I shall next venture to make a few observations on the method of SYMMETRIC PRODUCTS. Let $x_1, x_2,., x_n$ denote the roots of a given equation (in x) of the nth degree, and suppose that the product of $n-1$, linear functions of those roots, (viz.,

$$x_1 + ax_2 + bx_3 + . + lx_n$$
$$x_1 + \alpha x_2 + \beta x_3 + . + \lambda x_n$$
&c.,)

is a symmetric function of x (kk). Represent this product by $\pi(x)$, and let

$$y = Qx + x^2;$$

then $\pi(y)$ will be a function of Q and of symmetric functions of x; so that the equation

$$\pi(y) = 0$$

will be an equation of the $(n-1)$th degree in Q with known co-efficients. Now, supposing the equation of the $(n-1)$th degree to admit of algebraic solution, we shall, in some cases at least, be able to solve the given equation in x; for having solved the equation in Q we shall have the following for determining y:—

$$y_1 + ay_2 + by_3 + \quad . \quad + ly_n = 0$$
$$y_1 + y_2 + y_3 + \quad . \quad + y_n = A'$$
$$y_1y_2 + y_1y_3 + \text{\&c.} + y_2y_3 + \text{\&c.} = B'$$
$$\text{\&c.} \qquad = \text{\&c.}$$

The first equation of this group is obtained by replacing $\pi(y)=0$ by one of its known factors; the others are derived from the composition of equations. A', B', &c., are, of course, the co-efficients of the second, third, &c., terms of the equation in y, and are known functions of the co-efficients of the given equation in x. When $n=3$, or, 4 such *symmetric products* as those above alluded to can be formed (l); let $n=3$, then the last group of equations shows that the three values of y (viz., y_1, y_2, y_3,) are determinable by means of two linear and one quadratic equation, and consequently this case presents no difficulty. Having thus shown the application of this method of *symmetric products* to cubics, I shall defer the further discussion of this subject until I resume my remarks on biquadratics. The method is, however, applicable to the last named class of equations (m).

I am, Sir, yours, &c.,
JAMES COCKLE.

2, Church-yard-court, Temple,
May 12, 1847.

(k) If it were inquired [Kelland's *Algebra*, (Edin. 1839) p. 128, Art. 60, Prob. 1], *What number is that whose square exceeds it by 6?*—we arrive at the quadratic

$$x^2 - x = 6,$$

and, there being nothing in the problem to show whether the 6 on the right-hand side of this equation represents $(+1)26$ or $(-1)26$, and 6 being greater than $\frac{1}{4}$, we shall obtain two unambiguous solutions of the problem, viz., 3 and -2. But the latter is *arithmetically uninterpretable*.—J. C.

(kk) A little reflection will show that the supposition that the co-efficient of x is unity, in no way affects the result. We may determine a α, &c., *a priori*, without assuming any thing more than that they shall satisfy the condition of symmetry;—at least, this can be done for cubics and biquadratics. J. C.

(l) This may be gathered from p.p. 262—3, 265—7 of LAGRANGE's *Traité de la Résolution des Equations Numériques, &c.*, Note xiii. (3rd. Edition, Par. 1826). If I recollect right it is also mentioned by Sir W. R. Hamilton in the *Irish Transactions*.—J. C.

(m) See the *Philosophical Magazine*, Series iii., vol. xxvi, pp. 383—4, and the "Errata and Addenda" to that volume; vol. xxvii., p. 127, Art. 4, and p. 293, Art. 7; vol. xxviii., p. 133, Art. 6; *Mathematician*, vol. i., pp. 82—4, 113, 194—5, 297—9, and Art. 9, of p. 300; *Mechanics' Magazine*, vol. xliv., p. 406 (bottom of first and top of second column); vol. xlv., p. 36, similarly situated paragraph. The subject must not be considered as completed.—J. C.

ON THE PRODUCTION OF HEAT BY FRICTION.

Sir,—That the sensation of heat is produced by means of a certain imponderable form of matter, which we may call caloric, has been maintained by many eminent philosophers, and denied by many equally eminent. The latter have accounted for the existence of heat, by supposing it to consist in "motion among the particles of bodies," which motion "is communicated through an apparent vacuum, by the undulations of a very subtile elastic medium, which is also concerned in the phenomena of light."

The production of heat by mechanical means, appears to be considered as furnishing the strongest argument against the materiality of heat. Therefore, to show how the mechanical production of heat can be explained consistently with

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the theory that heat is material, is to add considerably to the strength of that theory, and to this point I shall chiefly direct my attention. The material theory is well supported by the phenomena of expansion, fusion, vaporisation, conduction, condensation, radiation, reflection, and refraction; but the production of heat by friction and percussion, is thought to be best explained by the theory that heat is motion.

We must first suppose caloric to be repulsive of itself, but that it is attracted by matter.

The heat evolved by the condensation or compression of matter, is readily explained by the material theory; for supposing 10 cubic feet of any substance to contain 5,000 atoms of caloric, we have in this case 500 atoms of caloric to each cubic foot of matter; but if the substance be subjected to a force which shall compress it to one-half of its former bulk, we shall then have 1000 atoms of caloric, instead of 500, to each cubic foot of matter, and accordingly a considerable increase of sensible heat. Now, friction and percussion can be explained in just the same manner. Friction is a kind of *running compression* (if I may use the term), being a compound of compression and motion. Percussion is a *sudden compression.*

Berthollet, by subjecting metals to the stroke of a coining-press, found that the degree of heat produced by percussion is always in proportion to the degree of condensation. The first stroke was more effectual than the second, and the second than the third, both with regard to heat and condensation.

How this can be made to militate against the theory that heat is material, I do not see; it appears to me to furnish a strong argument in its favour.

Count Rumford's experiments on frictional heat in the boring of cannon, are considered to raise considerable objections against the theory of caloric. In half an hour, by the mere process of boring, he raised the temperature of a cannon from 60° to 130°. The borer was pressed against the cannon, on an area of two square inches, with a force of 10,000 lbs. avoirdupois. The apparatus was wrapped in flannel and worked by horses; and the borer made 960 turns in the half hour. The iron abraded weighed 837 grains, being about ^{1} th part of the whole weight of the cylinder. This philosopher likewise bored a cylinder of brass, insulated in water. The borer was made to revolve by machinery, 32 times in a minute. At first the temperature was 60°, but after an hour's boring it was 107°; and in 2½ hours the water boiled. The whole apparatus, weighing 15 lbs., was raised to the same temperature.

These experiments are considered to prove that heat may be obtained without limitation, by the friction of insulated metals; and it is argued, that what can be obtained from insulated bodies without limitation, cannot be material. Now it appears to me, that one great source of heat is overlooked in this reasoning: I mean, the condensation of the metallic borings. It is unreasonable to suppose that a pressure of 10,000 lbs. could be exerted upon two square inches without producing some degree of compression. This compression causes an increase of heat in the condensed part, and the caloric thus rendered active is rapidly diffused through the cylinder, while at the same time the part compressed is cut away by the borer; so that the borings are condensed pieces of metal which have had some of their caloric squeezed out of them into the cylinder, which is thereby rendered hotter. Doubtless, if the bulk of the particles abraded were to be found, by immersing them in water, it would be found that they occupied less space than when they formed part of the solid cylinder. Some persons may be disposed to doubt, whether cold iron can contain sufficient caloric to raise its temperature so high; but let us consider, that matter attracts caloric, and iron is a very dense body, and accordingly must attract and retain caloric with considerable power; and this is the reason why it appears cold, when it really contains a great deal of heat. According to Dr. Black, this power of retaining strongly a certain portion of latent heat, gives the metals their ductibility. Moreover, as a great increase of heat in metals is requisite to produce a slight expansion, it might be expected that a slight degree of compression should cause a great evolution of heat.

From this consideration of the subject, it appears of very little consequence whether the metals undergoing friction are insulated or not, seeing that the heat

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can be produced directly from the bodies themselves.

Sir H. Davy, by making two pieces of ice rub against each other in vacuo, produced enough heat to melt them. This case is analogous to the boring of cannon. Certain particles of ice are compressed and abraded, and their caloric squeezed out and rendered active by the condensation. The analogy is still further supported by the superior density of the watery particles compared with the icy ones. Similar reasoning will apply to Boyle's experiment of producing heat by the friction of brass in vacuo.

Boring wood with a gimlet is also analogous to the boring of cannon; only in the former case, the metal having a stronger attraction for caloric than the wood has, it receives the greater part of the heat, and the gimlet soon becomes hot. This is the case in the school-boy's experiment of rubbing a button on a plank; caloric is squeezed out of the wood by the compression of its parts, and the button receives most of the caloric, owing to its strong attraction for it. It is easier to produce heat from the friction of rough surfaces than smooth ones, because in the former case certain particles are rubbed off, which being small, are readily condensed, and made to evolve their latent caloric.

Fulminating compounds are substances capable of igniting with a small degree of heat. When undergoing compression or percussion, their bulk is reduced, and their caloric concentrated in a degree sufficient to cause their ignition. When a chemical match is drawn over sand-paper, certain phosphoric particles are rubbed off, and being compressed between the match and the paper, their heat is raised sufficiently high to ignite them, and fire the match. If the match be drawn over a smooth surface, the compression must be increased, for the temperature of the whole phosphoric mass must be raised in order to cause ignition.

Dr. Young, in arguing against the material hypothesis, says that "if the repulsive particles of caloric followed each other at a distance, they would still approach near enough to each other in the focus of a burning glass, to have their motions deflected from a rectilinear direction." Perhaps this *is* the case, for we cannot see heat. It is actually found in the prismatic spectrum, that the heating rays extend beyond and outside the illuminating rays.

Trusting you will excuse the prolixity of my epistle, I remain, Sir,

Yours respectfully,

J. Pitter.

Hastings, May 14, 1047.

CARBINES' GUTTA PERCHA MINERS' FUSE.

In consequence of the editorial note subjoined to the abstract of Mr. Smith's specification, given in our last number, we have been challenged to make good, by "something more than *the mere claim*," our assertion that Mr. Smith has made free with the invention of Mr. Henry Carbines. We respond to the challenge.*

The patent of Mr. Carbines was dated 24th October, 1844; and, though the specification of it has not been published anywhere, we happen to know that the firm of Messrs. Bickford, Smith and Davey (the Mr. Smith of which firm, is the same Mr. Smith who now figures in the character of patentee and plagiary) were in possession of a copy of it long before the present attempt to misappropriate its contents.

The specification of Carbines consists of a great many heads. He describes, 1. Miners' fuses wholly of metal; 2. Miners' fuses partly of metal and partly of fibrous materials; 3. Miners' fuses wholly of fibrous materials; 4. Military fuses; 5. Mine cartridges; 6. Military and Sporting cartridges; 7. Powder-holders, and mine-charges; and 8 rockets, and other fireworks. It is the third of these heads to which our charge of infringement had reference, and which we now propose to lay *in extenso* before our readers, in proof of that charge.

But before proceeding to our extract, it may be proper to advert briefly to the state in which things were, as to miners' fuses at the date of Carbines' patent. The fuse then in universal use was that so well known as "Bickford's Miners' Safety Fuse," for which letters patent were granted to Bickford (the partner of the present patentee, Smith) 6th September, 1831, which expired 6th September, 1845. This fuse is made as

* Are we to understand, from the silence observed with respect to our other charge against Mr. Smith, of also infringing the patent of Mr. Bewley, that, so far, he pleads guilty?

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Fig. 1.

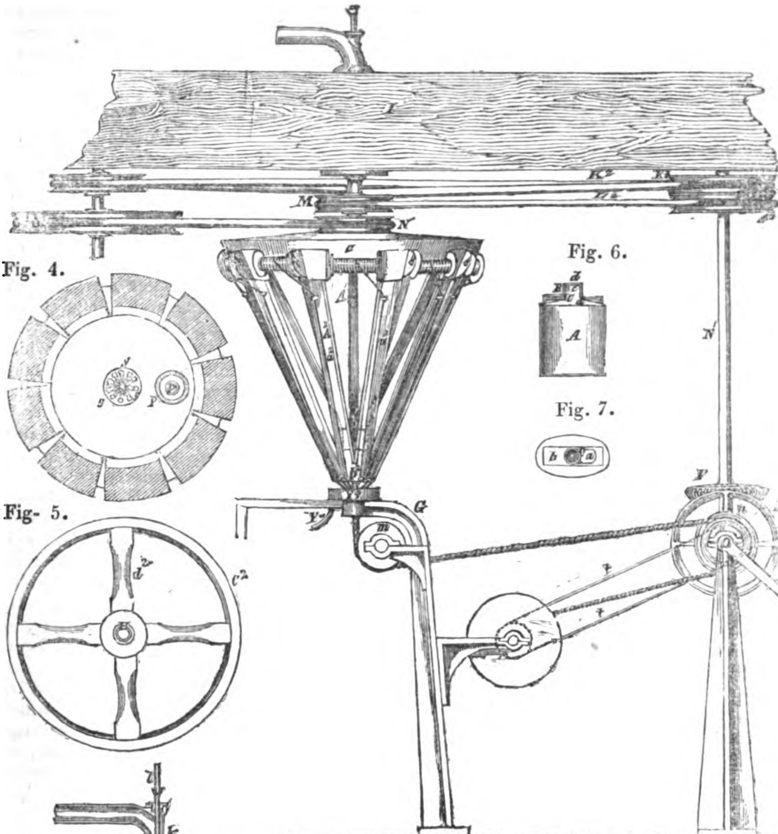

Fig. 4.

Fig. 6.

Fig. 7.

Fig- 5.

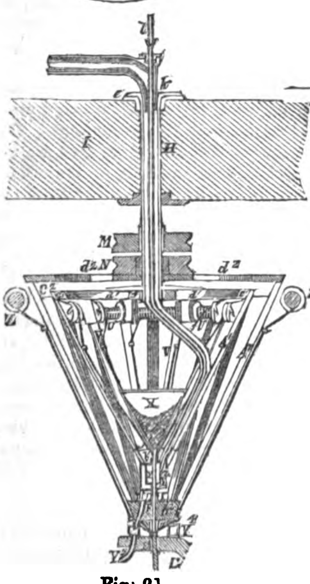

Fig. 2.

Fig. 8.

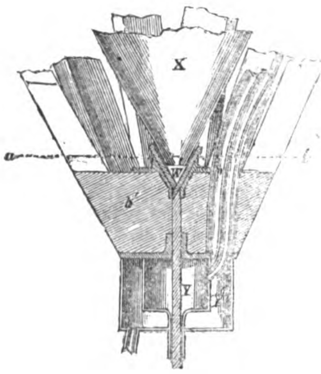

Fig. 3.

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follows:—Eight, ten, or more strands of hemp (or other fibrous material) are drawn through as many holes surrounding the mouth of a funnel, from which a thin stream of gunpowder is issuing, and twisted round in one direction, after the manner of single-twine spinning, so as to form a cord, with a thread or streak of gunpowder in the centre. The cord so formed is then made fast by "countering," as it is called, that is, by twisting a second cord of hemp (or other fibrous material) round the first, at right angles to it, in the same way as wire is commonly covered with thread. The double cord is then covered with a mixture of tar and rosin, to protect it from wet, and finally done over with ground chalk or whiting, to make it more fit for handling The chief defects of this fuse are, *first*, that the tarred and rosined twine takes fire on the explosion of the fuse, and continues burning for some time after, producing a thick, smothery vapour, extremely oppressive to the miner, especially in confined places; *second*, that it is liable to be cut through in the process of tamping, and thus to cause a premature explosion of the mine-charge; *third*, that the fuse sometimes fails to act, in consequence of an interruption to the continuity of the interior thread of gunpowder, arising through accident in the course of manufacture; and which, as its manufacture has been hitherto conducted, it is impossible to detect beforehand; and, *fourth*, that it is liable to be opened by a mere twist, and thus to allow the admission of water or damp to the powder.

Mr. Carbines proposes several modes of obviating these objections; but, for the present, we shall confine ourselves to those comprehended under the third of his specification, which is that, we say, which Mr. Smith has infringed:—

"*Miners' Safety Fuses wholly of Fibrous Materials.*

"I make fuses of the same materials as the 'Bickford Fuse,' that is, both the inner body and the countering, of twine; but I previously render the twine uninflammable by the means before described ('Hodgson's chemical concentrated Fire Preventive'), AND WATERPROOF THE FUSES BY ONE OR OTHER OF THE COMPOSITIONS ALSO BEFORE MENTIONED (a solution of gutta percha, or one of caoutchouc). I further manufacture these fuses in the improved manner next described. Figure 1 is an external side elevation of a machine which I employ for this purpose; figure 2, a sectional view of the principal part or body of the machine; fig. 3, a view on an enlarged scale of the principal working parts; and figure 4 a cross section on the line *a b* of fig. 3. A^1 and A^2 are two reels or frames, the one within the other, of the form of inverted cones, each consisting of a number of bars, a^1 a^2, placed at equal intervals apart, which radiate from a hollow boss or block, b^1 b^2, and are united at top by a ring, c^1 c^2, and cross-pieces, d^1 d^2, as shown in the separate top plan, fig. 5. The outer reel, A^2, rests and turns freely at bottom in a hollow pivot, which is screwed to the underside of the block b^2, and stepped in a bracket, G, which projects from a wall, or any other suitable support. The inner reel, A^1, turns in like manner at bottom, on a hollow pivot, F, which is screwed to the underside of its own boss (b^1), and stepped in the top of the other boss (b^2), which forms the bottom of the outer reel A^2. In both of the bosses b^1 b^2 there are holes which correspond with the orifices of their respective pivots. H is a hollow spindle, on which the two reels revolve at top; it is passed through the beam I, overhead, in which it is held fast by the flange *e*, then through two pulleys, M and N, and next through the top cross-pieces, d^1 d^2, immediately below the last of which it terminates. The two reels thus revolve freely round one common centre, which would be defined by a line drawn through the centres of the top spindle or axis, H, and the bottom pivots E and F. The pulley N has a brass bush, by which it is made fast to the top of the cross-piece d^1 of the reel A^2, and is the medium through which motion is given to that reel when acted upon in manner to be presently explained. The other pulley, M, is intended to give motion to the reel A^1, independently of the other; and this is effected by making it fast to the spindle H, which, passing freely through the bush of the pulley N and the cross-piece of the outer reel A^2, fits with sufficient tightness into a brass bush, *f*, in the centre of the top cross-piece d^1 of the reel A^1, to cause that reel to rotate when it has itself a rotary movement given to it. K^2 L^2 are bands, by which motion is given to the pulleys M and N, with the help of other pulleys, K^3 K^3, L^3 L^3, attached to the overhead beam I, from an upright shaft, N^1, which again derives its motion from a horizontal shaft, O, through two bevil-wheels, P P, which shaft is turned by hand power applied to a crank-handle, R (or may be turned by any other suitable power). The band K^2 is crossed so that, though the shaft O is turned

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round only in one direction, the two reels A^1 A^2 are made to revolve in directions opposite to each other. The inner of these reels, A^1, is employed to form the inner twist of the fuse, and the outer, A^2, to form the countering, each being mounted for the purpose in manner next to be described. U U are a set of bobbins, eight, ten, or more in number, which are suspended in brackets attached to the inside of the top ring of the inner reel, A^1, and carry as many balls of twine, previously rendered uninflammable by the means aforesaid. The axis of each bobbin rests loosely in clefts in the supporting brackets, so that it may be lifted out to pass the ball of yarn upon it, and as often again as a new ball is required to be put on. The ends of the different balls of twine are passed through the eyes V V, and thence through a circle of holes, *g g g*, in the top of a concentrating funnel, W, down the sides of which they are conducted by a series of grooves, indicated by the dotted lines *x x* in fig. 4, to the mouth of the funnel, where the whole of the strands are brought close together, but still in an untwisted state. X is a hopper, with a wide mouth, from which the funnel W is kept constantly filled with gunpowder, so that, as the twines pass out through the lower and smaller end of the funnel, they draw along with, and in the centre of them, a thin streak or thread of the gunpowder. On emerging from the funnel, the cluster of twines, with the streak of gunpowder in the centre, is immediately twisted by the rotary action of the reel A^1 into a cord, which, as soon as formed, passes into a box, Y, *where it is waterproofed by means of a solution of caoutchouc, or gutta percha, thickened with white lead*, supplied from a reservoir through a pipe, P, which is carried down through the hollow spindle H, and through the interior of the reel A^1, as shown in fig. 2. *To keep this solution always in a fluid state*, the pipe P and box Y are enclosed in an outer pipe, *p*, and outer box, Y^2, *which are filled with steam from a boiler;* and to prevent any superfluous quantity of the solution from adhering to the cord, it is next passed through a hole in the bottom of the box Y, of the exact size of the cord, so that any superfluous solution is removed as it passes through. As the pipes P and *p* must necessarily revolve with the reel A^1, they are made to do so by means of universal joints placed at the points *k* and *l*. The steam, as it condenses, passes off from the box Y^2 to an annular chamber Y^3, whence it escapes into another annular chamber Y^4, placed on the bracket G, from which it is conveyed by the pipe Y^5 to the external atmosphere. The inner twist or cord which has been thus formed, filled with gunpowder and waterproofed, is then passed down through the bottom pivots E and F, and while passing through F it is countered by means of the outer reel A^2 in manner following:—Z Z are a second set of twine bobbins, which work in brackets fixed on the outside of the top ring of the outer reel A^2, in the same way as the others. The yarns or twines from these bobbins are carried through a circle of holes in the hollow pivot F, where, by the rotation of the reel A^2, they are twisted round the single cord previously formed, but in an opposite direction, *and cemented thereto by the waterproof coating, which is still in this stage of the manufacture in a warm or sticky state.* The rope of fuse is then in a finished state, and as it emerges from the hollow pivot F, it is drawn off round the pullies *m* and *n* (the latter of which is roughened on the surface to facilitate the operation), whence it is drawn round upon the receiving-reel p^1, which is driven by a slack belt *t* from a pulley *s*, on the end of a horizontal shaft O. *The waterproof coating introduced between the inner twist and the countering will generally be found sufficient to exclude wet and damp; but should still greater security be desired, the rope of fuse may have another coating of a thin solution of caoutchouc or gutta percha given to it.*

"The advantages of the improved mode of manufacture just described are—First, that by the mere turning of the crank-handle R, or one application of manual or other power, the whole machinery employed is put in motion; that the various processes are performed in such quick succession, that not an instant of time is lost; and that a rope of fuse is at once produced in a finished state, requiring only to be cut up into short lengths for use. Second, that, by supplying the gunpowder as before described, that is, by passing it from a hopper with a large mouth into a funnel with a narrow mouth, from which last it is drawn out by the friction of the yarns or twines (instead of supplying it directly from a funnel by the mere force of gravity alone), there is always a certainty that there will be the streak or thread of gunpowder required in the centre of the fuse. And, Third, *that the tar and resin are dispensed with, and the waterproofing being introduced between the inner twist and the outer countering, serves at the same time to cement the two courses of twine together, and thereby to render the fuse firmer and stronger.*"

If the reader will do us the favour to compare the latter half of the abstract of Mr. Smith's specification, given in our last number, with the parts of the pre-

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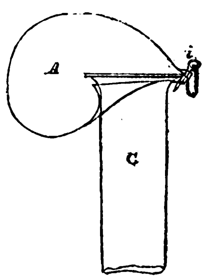
ceding extracts which are given in Italics, he will see at once that, in all that regards the waterproofing with gutta percha, Smith's process is, to all intents and purposes, a literal copy of Carbines'.

LOCOMOTIVE CHIMNEY-SHIELD.

Sir,—If you consider the following suggestion worthy of insertion in your valuable Magazine, I think it would be the means of drawing more attention to what, in my opinion, has hitherto been too much neglected.

As far as I can judge, it is intended, in the majority of arrangements for preventing cinders being thrown out of the chimneys of locomotive engines, to throw the cinders back again into a receiver, or into the smoke-box.



Why are they not allowed to come out of the draught, and caught up afterwards? I think the following plan would answer such a purpose, and might be carried out with little expense on most of the locomotives:

A wire net A, formed like a bag, is hung over the top of the chimney C, and secured to the rim of it by a pin *i*, in such a way as easily to be turned to that side of the chimney over which the steam issues. The meshes of the net should be so narrow as to prevent the escape of cinders large enough to cause danger. As soon as a quantity of cinders have been collected, the bag may be taken off and emptied.

I am, Sir, yours, &c.,

C. S.

Manchester, May 3, 1847.

THE DECIMAL COINAGE.*

Nearly a quarter of a century has elapsed since a commission was appointed to inquire into the English system of money, weights, and measures. This is one specimen of the way in which governments, such as ours, contrive to place in abeyance any social or economic question which is strongly pressed upon them, but which they do not think it convenient to entertain. A blue book is issued; or if time be required by the minister, and any influential section of the public be pressing, two or ten in succession. A lull then ensues; and when the topic is again brought forward at twenty or thirty years' distance of time, some trivial concession is made, and the minister goes to his "comfortable snooze" again.

The subject was again brought forward a week or two ago by that thorough master of his subject, Dr. Bowring. He asked only for a reform in the coinage; and even this the Chancellor of the Exchequer refused, beyond the coinage of *two-shilling pieces!* As to the Master of the Mint, the sorry exhibition of his monetary knowledge was a fine illustration of the *fitness* of political men and "spouters of froth by the hour," for filling offices of state importance. Mr. Shiel's speech might have passed in the "House" for the purpose of using up time till members could retire, and allow it to be "counted out:" but for the speech of a public functionary, the head of the Mint, it was most disreputable. Two-shilling pieces of silver we are to have, however: but still no attempt is made farther to simplify our barbarous system of either money, weights, or measures. We are behind the rest of Europe,—even small states: and our statesmen feel no shame, as long as their indifference does not lead to universal bankruptcy! Of course, money is money whatever name and size the coin may have; and as the present system only creates the inconvenience to the merchant of being obliged to employ five clerks instead of three, the difference of the salaries can hardly lead to mercantile insolvency, and the *incon-*

* "Simple Arithmetic, as connected with the National Coinage, Weights and Measures. By Henry Taylor. Groombridge, 1847."

venience is *therefore* of no moment. In one respect it would be a disadvantage to the government to simplify these matters, since it would diminish the number of clerks in the public service—diminish government patronage—and consequently diminish the number of electoral votes at the command of sundry members who support the minister. Yet the mercantile, the manufacturing, and the operative interests, are all in some degree involved in this reform. It must come, however tardily.

The best years of a boy's life—full one half of the boys in this country who receive any education at all—are wasted upon the acquisition of a set of mere artificial rules for arithmetical computation, under the name of "commercial arithmetic." All the reasoning powers of the mind lie dormant; youthful curiosity, which might be turned to so much amount in studying the phenomena of terrestrial nature and the wonders of the heavens, is repressed by the study of "tare and tret, cloff and suttle," and such like conundrums. The native taste and feeling of boyhood, which might be effectively developed by the study of a better order of literature, is annihilated by piles of figures and cramped arithmetical questions, and only shows its existence by the stolen indulgence in a love for trashy two-penny novels, and impure principles dressed up by a Bulwer into "an affecting romance."

We have said something respecting the "College of Preceptors" in another part of the present number; and we might have recommended *this* as a proper subject for the "M. C. P.s" to move in. They have not done so: nor are they likely. In fact, the persons who are enrolled under this banner are precisely those who have *most to lose* by such a change. It would destroy the "occupation" of our Othellos; and they would be compelled to study something more than arithmetic and English grammar for the occupation of their pupils. No hope for co-operation is likely therefore to be justified by the College of Preceptors. Yet the reform will come to pass, notwithstanding.

Meanwhile, the question must be kept in a state of discussion. This agitation will ultimately lead to the accomplishment of the object. The most effective shape in which it can now be discussed (for its *advantages* are no longer questioned), is the *best form* in which the system can be carried out, without the least disturbance to our ordinary habits. It seems admitted on all hands that our unit of value shall be the *pound sterling*. This principle, too, is that adopted by the Chancellor of the Exchequer; and the coinage of a tenth part of this unit is properly considered as a first step towards a universal decimal coinage. Independent of the convenience of this mode of starting with an existing coin which is already familiar, without the least inroad upon our ordinary habits, the pound sterling is a better unit of account than the franc or the dollar. Were it only for the convenient run of the eye over the figures of a large sum, or the enunciation of the value in words, the convenience of the larger unit of account will be apparent. These, however, are not all the advantages; but as the principle appears to be universally conceded, it will be useless to dwell upon them.

The most effective mode of keeping attention alive to this subject is, the publication, in an accessible and inexpensive form, of works like that which has given rise to these remarks. Mr. Taylor has done *essential service* to the cause of the decimal system, by pointing out the extreme simplicity which may be given to it without any violent innovation upon our existing habits. He shows much address, and a complete mastery over his subject, in meeting the objections which the petty order of "conservatives" are likely to make. In connection with this tract, too, we shall also recommend our readers (as Mr. Taylor has done) to consult Professor De Morgan's article in the "Companion to the Almanac" for 1841. The latter will probably *now* be difficult to procure; but, to most minds, we apprehend that Mr. Taylor's "Simple Arithmetic" will be perfectly conclusive; and to those of our readers who take an interest in

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the subject, we cordially recommend a careful and reiterated perusal of this judicious and clear-headed contribution to our commercial and social literature.

THE DECIMAL SYSTEM.

Dear Sir,—The reduction of a pound sterling to the *decimal system* according to its present value would be rather awkward; the two highest denominations would certainly answer well enough, being 20s. and 2s.; but the remaining two denominations would be ill understood by the million, viz., $2\frac{2}{5}$ pence (less than $2\frac{1}{2}$d.) and $\frac{6}{25}$ of a penny (less than one farthing). Now, if 10 pence, or 40 farthings be added to a pound, thereby making it 1000 farthings, or *minims*, the decimal system would be at once obtained.

			Present value. s.	d.	Written thus.
Thus, 1000 minims	=	1 Victorine	= 20	10	V 1.
100 ,,	=	1 decime	= 2	1	.1
10 ,,	=	1 centime	= 0	$2\frac{1}{2}$	.0 1
1 ,,	=	1 minim	= 0	$0\frac{1}{4}$	.0 0 1

The Imperial Monetary Table would therefore be

10 minims = 1 centime
10 centimes = 1 decime,
10 decimes = 1 Victorine.

In writing any sum according to this scale all that is necessary is to place the decimal point on *the right* of the Victorines, and to write the other denominations as a decimal. Thus, write 576 Victorines, 7 decimes, 5 centimes, and 4 minims; ans. V576.754. Now, this can be added to, substracted from, or multiplied and divided by, any number precisely in the same manner as in simple numbers, and the result would be so many Victorines, decimes, centimes, and minims. Here, then, is at once a *decimal scale* for our monetary concerns.

In money, weights, and measures, however, the highest denomination in each should not, if possible, be disturbed. The above slight alteration in our present pound is, however, an evident improvement, as it gives the values of the given names or denominations in amounts understood by every body. If any of your intelligent classical correspondents will suggest more appropriate names for the different denominations, I shall feel obliged.

I am, Sir, yours, &c.,
WM. RUSSELL.

180, Prospect-place, Edgeware-road,
May 14, 1847.

MODERN ANTIQUES.

"Multa renascentur quæ jam cecidere, cadentque
Quæ jam sunt in honore."

Sir,—The above saying of Horace, though by him limited to words, has often struck me as being much more extensively applicable to fashions, for instance, and the manner of thought and feeling of an age; but more especially is it applicable in the case of mechanical inventions. It has at present been brought to mind by a scarce and curious book now lying before me (lying, I am afraid, at times, in more senses than one), intituled "Mathematical Recreations; or, a Collection of Sundrie Problemes, &c. &c., most of which were written first in Greeke and Latine, lately compiled in French, by Henry Van Etten, Gent., and now delivered in the English Tongue, with the Examinations, Corrections, and Augmentations. Printed at London, by T. Cotes, for Richard Hawkins, dwelling in Chancery Lane, near the Rowles, 1633."

Most of your readers will remember, some six or seven years ago, a novelty in the shape of a glass making its appearance at various shops and places of scientific amusement in London. Sometimes, to all outward seeming, it was a tumbler of high-frothed porter (with the cauliflower on), that elicited a scream on its being apparently thrown over you, and then admiration as to how you could have remained dry; at other times, it was a delusive glass of the palest sherry, which

"Poor thirsty Tantalus, alas! in vain
Essays to drink—his lips the stream eludes:"

and now let them hear this *novelty* described in problem 39 of the Mathematical Recreations:—

"*Of a Glasse very Pleasant.*

Sometimes there are glasses which are made of a double fashion, as if one glasse were within another, so that they seeme but one; but there is a little space

between them. Now poure wine or other liquor betweene the two edges by helpe of a funnell, into a little hole left to this end: so will there appeare two fine delusions or fallacies; for though there be not a droppe of wine within the hollow of the glasse, it will seeme to those which behold it, that it is an ordinary glasse full of wine, and that especially to those which are sidewise of it; and if any one remove it, it will much confirme it, because of the motion of the wine. But that which will give most delight, is that if any one shall take the glasse, and putting it to his mouth, shall thinke to drinke the wine, instead of which he shall suppe the aire; and so will cause laughter to those that stand by, who, being deceived, will hold the glasse to the light, and thereby considering that the rayes or beames of the light are not reflected to the eye, as they would be if there were a liquid substance in the glasse, hence they have an assured proofe to conclude that the hollow of the glasse is totally empty."

What a comfort would it be to those who have been thus pleasantly deluded, to know that their grandfathers' grandfathers have been in like manner deluded before them; though, at the same time, I am sure they must regret that such a philosophical way of proving the emptiness of the glass never occurred to them.

Again, at page 196, there is the description and view of a pump, revived in modern times, as "Rangely's Patent Roller-Pump" (for a description of which see *Mech. Mag.*, vol. i., p. 203); only here it is called "a fine fountaine of pleasure," and also "a most soveraigne engine to cast water high and farre off to quench fires."

In another place is a description of a steam-gun, not noticed I believe by any of the writers on the early history of steam. But it would require more space than you could afford, to enumerate all the remarkable problems in the book. With a great number of them, the rising generation is already acquainted—though probably they are unaware of their antiquity—by means of the *Boy's Own Book*. Let them no longer fancy that the feat of raising a bottle with a straw, or balancing a stick by means of two knives, was invented, however, for their gratification. To return to the subject of revived inventions. About two years ago, a new instrument for copying mouldings, &c., attracted some notice, which I was amused to find in all respects the same as the instrument described just twenty years before at page 57 of your fifth volume. Every one must have heard of the action for the infringement of a patent right for a peculiar description of weaving, when the defendant gained the day by producing a bandage from an Egyptian mummy woven in the patent manner — thus proving the invention to belong to the time of the Pharaohs.

What visitor to the "Industrious Fleas" will not be surprised to hear from Stowe, that in the time of good Queen Bess, one Mark Scaliot, a blacksmith, had a flea manacled with a gold chain of 43 links, with an iron, steel, and brass lock of eleven pieces, and a pipe key; the lock, key, chain, and flea weighing, in all, one grain and a half? That Scaliger gives an account of one chained in a similar manner, and "kept daintily in a box, which for food did suck her mistress's white hand;" and that another was seen at Cairo by Leo Afer in the fifteenth century? Who would have thought that glass hives, false teeth, parasols, wigs, and horn lanterns, had been known to the ancients? Yet we read of them in Pliny and Martial. What traveller, when feasting on his *pâté de foie gras* at Strasburg would have imagine that luxury to have been known, to the Romans? Yet it was not only known but appreciated. Even the usually staid Pliny breaks out into rhapsody when over his geese: "Nostri sapientiories qui eos jecoris bonitate novere. Fartilibus in magnam amplitudinem crescit, exemptum quoque lacte mulso augetur;" and then he enters into a discussion as to who was the first discoverer of so great a good—"quis tantum bonum invenerit"—for even for the honour of having introduced a liver complaint among the geese there are two competitors, Scipio Metellus and Marcus Sestius. May both their names be held in veneration! Martial bears witness to the size which these artificial livers obtained:

"Aspice, quam tumeat magno jecur ansere majus!
Miratus, dices: hoc, rogo, crevit sibi."

Even the much boasted invention of the power-loom is not so modern as generally supposed; as it is related by Lancellotti (before the middle of the seven-

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teenth century) that an engine that would weave four or five webs at a time, that moved of itself, and would work night and day, was erected at Dantzic; but the invention was suppressed, and the artificer made away with secretly, because it would prejudice the poor people of the town.

Many more such instances of resuscitation might be adduced, but I will only add that these can never be fairly used as arguments against the originality of the second inventions; and have now been brought forward partly as amusing coincidences, and partly to show that we of the nineteeth century are not so infinitely in advance of by-gone ages as we often so fondly imagine; and as instances that verify the saying of the preacher, "The thing that hath been, it is that which shall be; and that which is done is that which shall be done; and there is no new thing under the sun."

I am, Sir, yours, &c., J. E.

BLASTING WITH GUN-COTTON—CONTINUATION OF EXPERIMENTS.

Letter from Mr. John Thornton, of Woodhead, addressed to Messrs. Ingram and Clarke, Liverpool, the Agents of Messrs. John Hall and Son, the Patentees of the Gun-Cotton, regarding Experiments at the Woodhead Tunnel, near Manchester.

Woodhead Tunnel, May 15, 1847.

Gentlemen,—Below I beg to hand you the result of a series of experiments made on the 13th instant, with the view to test the value and utility of gun-cotton in mining operations at the works of the above tunnel, now being carried on by G. C. Pauling, Esq., Manchester, contractor. There were present to witness the experiments, Mr. H. C. Campbell, of Manchester; Mr. H. J. Pauling, Manchester; Mr. Sharpe, Manchester; Mr. S. Smith, Manchester; Mr. John Halstead, the company's superintendent; and Mr. John Thornton, of Woodhead; with a number of foremen and officers connected with the works.

Experiment No. 1; in No. 1 cross-drift at west end of tunnel, the hole 3 feet 6 inches deep in hard millstone grit, with a charge of 10 ounces of cotton, did more execution than any quantity of powder would have done under the same circumstances.

Experiment No. 2; in the same place and strata, the hole 3 feet 3 inches deep, with 8 ounces of cotton, did the same execution that is generally done with 3 lbs. of powder—moved about 2¼ tons.

Experiment No. 3; in open face, at west end of tunnel, in the millstone grit, hole 4 feet 4 inches deep, 4 feet from face, with a charge of 4 lbs. of powder; moved 28 tons.

Experiment No. 4; in the same face, with a charge of 11 ounces of cotton, 4 feet from the face, and 3 feet 9 inches deep; moved 28 tons, but did not throw it about in the same manner that powder does.

Experiment No. 5; in the same face, with 8 ounces of cotton, moved a great space, but did not break it up. Charge appeared too small; 6 feet from face and 5 feet deep.

Experiment No. 6; in same face, with a charge of 3 lbs. of powder; 6 feet from face, and 5 feet deep. The result was the same as in the former experiment; the charge appeared too weak.

Experiment No. 7; in cross-drift No. 15, in hard, dark shale, a charge of 8 ounces of cotton, 3 feet deep; did the same execution that is usually done with about 3 lbs. of powder.

Experiment No. 8; in open face, at east entrance of tunnel, a charge of 8 ounces of cotton, 4 feet 6 inches from face, in beds of hard sandstone rock and shale alternating, the charge, placed 5 feet 6 inches deep; moved about 14 tons.

Experiment No. 9; in the same face, with 10 ounces of cotton, placed at 6 feet from the face, and the hole drilled 6 feet deep; but, by some mismanagement, the cotton was placed at the depth of 3 feet. Moved about 16 tons.

From the above experiments, it will be seen that the results were very satisfactory, and I have no doubt that, from its portability and safety, if the price can be so regulated as to make the cost of it below that of powder, it will entirely supersede it in all operations where powder is at present required. In long drifts and headings, where the want of fresh air is severely felt and difficult to be had, the cotton has a decided superiority over that of powder, as it creates no smoke or stench, and the men can return to their work immediately after firing; whereas, with powder, they are sometimes detained a considerable period before they can return, which involves a great loss of labour.

I think, if the present 6 or 8-ounce charges could be condensed into about half the length, that they would have much better effect, where short holes are required, in such places as headings, drifts, &c.

Trusting that, as soon as you have perfected your arrangements, you will forward me a supply of the cotton; in the mean time I beg to remain, Gentlemen,

Your obedient servant,

JOHN THORNTON.

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CLARK AND VARLEY'S RESILIENT ATMOSPHERIC RAILWAY.

We paid a visit the other day to the working model of this system of atmospheric propulsion, now exhibiting on the grounds of the Blackwall Railway Company, and were much gratified at the very favourable results which we witnessed. The experimental line of railway is 250 yards long, and the main 15 inches in diameter, and of 90 yards in length. The weight of the carriage propelled was $2\frac{1}{2}$ tons; and it attained, towards the end, a speed, as near as could be ascertained, of 30 miles per hour, with a pressure on the piston of $\frac{1}{2}$ lb. to the square inch.

We remarked that the patentees had introduced several modifications and improvements, without affecting the peculiar characteristics of their invention, which are described in vol. XLV., pp. 49 and 108, as consisting in the resiliency of the tube, which keeps a longitudinal slit, in its upper surface, constantly closed; and in the absence of the ordinary valve, together with all its complication of machinery, sealing, wear and tear, and uncertainty and inefficiency of action.

The present tube is made in sections of iron boiler-plate, $\frac{1}{4}$ of an inch thick, rolled and hammered internally until formed into a perfect cylinder, of sufficient resiliency to close with moderate force. The edges of the longitudinal slit are cut parallel, and made to correspond so truly, that the use of vulcanized India-rubber between has been found unnecessary. The ends ofeach section are planed, and have a rebate cut in them of one inch round, and in which a strip of vulcanized India-rubber is cemented. A girder, or band of iron, is tightly keyed up over the joint, which is thus rendered air-tight and elastic.

On either side, and extending the whole length of the tube, is a horizontal bar, supported by uprights fastened to the sleepers. The horizontal bars are somewhat higher than the tube, to which they are attached in such manner, that when forced outwards, they shall open the tube, and when that force is removed, shall close.

The tube is opened for the passage of the piston by means of four wheels (fixed two and two in an iron frame attached to the coulter), which, being of the necessary diameter, are made to pass in between the two horizontal bars, and, pressing them outwards, to open the tube to the extent of $\frac{5}{8}$ of an inch. By this arrangement, the connecting plate passes between the edges of the tube, without touching, and wear and tear by friction is entirely prevented.

In order to avoid any strain or friction on the axles of the wheels, they are made of such diameter that their peripheries shall touch, and the pressure be thus transferred from the axles to the tyres of the wheels.

The piston is fixed like a throttle valve, which admits of its being made to assume a horizontal position, and of the vacuum being thus destroyed at pleasure.

WARNER'S LONG RANGE.

House of Commons.—May 13.

Mr. Aglionby inquired whether the hon. baronet, the member for Liverpool, meant to draw the attention of the House to the invention of Captain Warner, and the experiments adduced in favour of it?

Sir H. Douglas said,—In reply to the question put to me by the hon. member for Cockermouth, I beg to say, that the Report and Journal of the Proceedings of the Commission appointed to examine Mr. Warner's "long range," having proved, by actual experiment, in the presence of highly competent judges accepted by him, at his own time and convenience, and at the public expense, that Mr. Warner's alleged invention of an agent, of far surpassing and amazing power of range, over which, after years of toil and study and expense, he had acquired complete control, which he could aim with accuracy and with infallibity of effect, turns out to be—

Mr. Aglionby rose to order. He had asked a simple question; if the hon. baronet made assertions, he would have to make counter-assertions.

Sir R. Peel observed, that a simple answer to the hon. member's question would imply that Captain Warner had succeeded. (Hear, hear.) The question itself was not an usual one.

Sir H. Douglas continued.—I say, Sir, that the alleged invention of Mr. Warner turns out to be, as I always knew it would, *the greatest imposition ever practised upon public credulity and gullibility.* I would not offer such an insult to the good sense of the House of Commons as to call the attention of the House, in any other form, than to refer to these papers, to an absurdity which has already occupied, most unworthily, a considerable portion of the time of the House, in three long discussions; but which I feel sure the House, the Government, and all persons of sound sense, science, and judgment, will now deem totally unworthy of any further consideration. (Hear, hear.)

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MESSRS. BROCKEDEN AND HANCOCK'S IMPROVEMENTS IN INDIA RUBBER AND GUTTA PERCHA ARTICLES OF MANUFACTURE.

[Patentees William Brockeden and Thomas Hancock. Patent dated November 19, 1846. Specification enrolled May 19, 1847.]

The patentees state that their invention consists of a peculiar means of applying caoutchouc and gutta percha to a variety of purposes to which they have not heretofore been applied by means of the processes described in the specification of Mr. Alex. Parkes, published in the *Mech. Mag.*, vol. xlv., p. 400; and that although they have adopted the terms India rubber and gutta percha because most convenient, they desire to be understood as including all those varieties of hydro-carbons, known to botanists as of vegetable origin, and which varieties take their names from the countries whence they are exported, as Saikwah, West Indian, Madagascar, Java, &c.; or from names given by the natives, such as jintawan, gutta tuban, gutta percha, dolla, &c., or from the state in which it is imported, such as liquid, bottle, root, scrap, &c., all of which details have been described by Dr. Roxburgh, Lieut. Veitch and others, in the Reports of the Proceedings of the Agricultural and Horticultural Society of India.

When India-rubber (the vegetable substance known by that name), or any of its varieties, all of which differ from gum, sugar, starch, &c., in not being soluble in water, however compounded, is employed for the purposes of manufacture, they are subjected to the same, or very similar processes, viz., rolling, masticating, &c. From all these varieties caoutchoucine is obtained by destructive distillation, and all effected by the same solvents.

When gutta percha is to be used, the spreader and bed of the spreading machine have to be kept at a temperature of from 190 to 200 degrees Fah.—a great disadvantage attending which is stated to be that, although it is considerably harder than India-rubber, yet, in comparison with the latter, it is affected at comparatively low temperatures.

The present patentees render leather, cloth, and other fabrics, partially or entirely waterproof, by coating them with caoutchouc or gutta percha, or a compound of both, in solution or otherwise, and then immersing them in a bath of a solution of chloride of sulphur and bisulphuret of carbon.* When the fabric is coated on one side only, the selvage edges are to be joined as well as the ends, and, in this bag-like form, immersed. In order to stop out the injurious effect of the solution on the fabric, that part which it is desirable to protect should be coated with glue or size, or with an aqueous solution of shellac. The former may be removed by the application of hot water, and the latter by that of any suitable alkaline solution, when the process is completed.

The surfaces of the fabrics may be embossed, printed, and ornamented, prior to or after the "change."

The patentees give a very long list of articles of all kinds, and for all purposes, to which their invention may be applied; and conclude with stating, that whereas Mr. Parkes proposed to immerse caoutchouc and gutta percha, or a compound of both, in a raw state, their invention consists in immersing them in a manufactured state. And, farther, in subjecting the different articles, manufactured from caoutchouc, under the various patents of Mr. Hancock, such as thread, sheets, &c., to "change."

* When speaking of this process of Mr. Parkes, Messrs. Brockedon and Hancock adopt his phraseology, and call it a "change," and the means whereby it is effected, "immersion."

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 481.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

Joseph Severne, of Bromyard, Hereford, surgeon: of a remedy for the ague, called (by the specifier) "The Aromatic Ague Cake." Cl. R., 26 Geo. 3, p. 9, No. 24. Dec. 19, 26 Geo. 3; Dec. 29, 1785.

John Butler, of Caerleon, Monmouth, Esq.: of a new method of making bolts and brazier, or other rods of or from iron, copper, or brass, or iron shearings, for ships or other purposes, upon a new principle. Cl. R., 26 Geo. 3, p. 9, No. 4. March 4, 26 Geo. 3; March 15, 26 Geo. 3, 1786.

Thomas Mead, of Sandwich, carpenter: of an automaton or machine upon a self-moving principle, which, when in motion, will acquire and preserve velocity and force sufficient to work every kind of mill, crane, pump, and all other engines and machines in general, and give motion to any sort of carriage or vessel. Cl. R., 26 Geo. 3, p. 10, No. 10. April 20, 26 Geo. 3; May 19, 1786.

Walter Taylor, of Southampton, blockmaker: of a great improvement in the construction of machines for grinding grain of all kinds, and also starch for hair-powder,

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as well as all other matters where stones are now used; also for coaking or bushing and greasing of shivers and pulleys of all kinds. Cl. R., 26 Geo. 3, p. 12, No. 5. Oct. 30, 27 Geo. 3; Nov. 10, 1786.

Hugh Dixon, of Clerkenwell, chemist: of certain considerable improvements in the construction of telescopes, microscopes, spectacles, and all other instruments of vision, either by reflection alone, or compounded of refraction and reflection, whereby the field of view is greatly extended, and objects rendered much more distinct than at present. Cl. R., 26 Geo. 3, p. 14, No. 9. Dec. 14, 26 Geo. 3; Jan. 13, 1786.

(*To be continued.*)

An Old Engine of the Old School.—There is now in full work at the Tredegar Old Mill Iron Works a steam engine which was erected by Boulton and Watt, upwards of forty years ago, and is now nearly as good as ever. A few weeks ago it turned out, between one o'clock on a Monday morning and eleven o'clock on the following Saturday night, no less than 566 tons of rails, rolled and finished, and 289 tons of puddle bars—total, 855 tons.

LIST OF ENGLISH PATENTS GRANTED FROM MAY 14 TO MAY 18, 1847.

John Tattersall Cunliffe, of Manchester, hide-merchant, for certain improvements in "pickers" for power-looms, and also in the tools, or apparatus, for manufacturing the same. May 14: six months.

John Thomas Gray, of Wardour-street, Middlesex, bootmaker, for an improved boot and shoe. May 14; six months.

Thomas Shipp Grimwade, of Sheepcote Farm, Harrow-on-the Hill, Middlesex, for a new mode of reating milk for purposes of nutriment. May 14; ix months.

Thomas Hazeldine, of Brudenell-place, New North-road, Middlesex, engineer, for improvements in the construction of furnaces. May 18; six months.

Richard Peyton, of the Bordesley Works, Birmingham, metallic bedstead manufacturer, Jonathan Harlow, of Bordesley Works, aforesaid, and Thomas Horne, of Borough of Birmingham, brass-founder, for improvements in the manufactures of bedsteads. May 18; six months.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
May 13	1064	Henn and Slatter	Birmingham	Spring for runners for umbrellas and parasols.
14	1065	William Dray	86, Chiswell-street	Universal dove-tailed fastening for corkscrews.
15	1066	Samuel Messenger	Birmingham	Buffer and railway lamp.
17	1067	Henry Skinner and Jno. Jasper Gerlach	119, Union-street, Southwark, and 35, Thomas-street, Hackney-rd., London	Ventilating hat.
,,	1068	William S. Burton	39, Oxford-street	Sponge bath.
,,	1069	Henry Fogden	Pagham, Sussex	Improved horse hoe.
18	1070	Rider, Brothers	61, Redcross-street, Southwark, London	Hat leather or round.
19	1071	Joseph Taylor and Son.	Warwick-lane, Newgate-street, London	Protector engine.
,,	1072	Welch, Margetson, and Co	134, Cheapside	Aerial stock.
,,	1073	Joseph Schofield	Bradford, Yorks	The pessary for prolapsus uteri.
20	1674	James Chesterman and John Grattan	Both of Sheffield, in the county of York	Portable travelling case.

Advertisements.

Drawing-room and Out-door Pastimes,

OR the Art of Sketching from Natural Objects, in relative proportion, together with a Newly-Invented and Registered Instrument for simplifying Perspective, by G. Earl, Principal of the School of Design, Peckham. Second Edition, price 10s.

Medes, Camberwell; Reeves, Cheapside; Winsor and Newton, Rathbone-place; Ackerman, Strand.

TESTIMONIAL.

Professor Royal, Observatory, Greenwich.

"Sir,—I think your instrument, the Goniometricon, is well adapted to give learners a correct idea of drawing lines to the vanishing point, and calculated to be very useful.—G. B. AIRY."

The Gutta Percha Company

INVITE the attention of Engineers, Machinists, Mill Owners, &c., to the PATENT GUTTA PERCHA DRIVING BANDS, which possess the valuable properties of great durability and strength, permanent elasticity, and uniformity of substance and thickness, thus avoiding all the irregularity of motion occasioned by piecings and inequality of thickness of leather straps. They are not affected by fixed Oils, Grease, Acids, Alkalies, Water, &c., and possess extraordinary facilities for being joined, and hug their work in a remarkable manner. Can be had of any width, substance, or length, without joints.

The Company continue to receive most satisfactory Testimonials o the superior quality of these Bands, which can be seen at the Company's Works, Wharf-road, City-road, where all orders will receive immediate attention. E. GRANVILLE, Manager.

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The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs. T. Burnell and Co., 1, Great Winchester-street, London.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

NOTICES TO CORRESPONDENTS.

Trio.—A fly-wheel may, in a certain sense, be correctly said to increase the power of an engine; for, since its office is to accumulate power at one time, in order to give it out at another, it does enable the engine to do more work, *on the average, than it could otherwise do.*

A. M. G.—The English patent taken out by Gay Lussac, was dated June 9, 1825.

H. B.—Apply to Mr. V. Price, 14, *Poultry.*

J. G. C. wants a manumotive carriage, to work with the hands alone; "for, being a cripple, he is unable to use his legs." Can any of our readers inform him where such a carriage is to be had?

J. M. F.'s plan of steam ploughing differs in nothing material from Mr. Osborne's, described in No. 1225.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W.C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1242.] SATURDAY, MAY 29. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

BESSEMER'S AIR-DEFLECTING RAILWAY CARRIAGES AND COMPOUND RAILWAY CARRIAGE-AXLES.

Fig. 1.

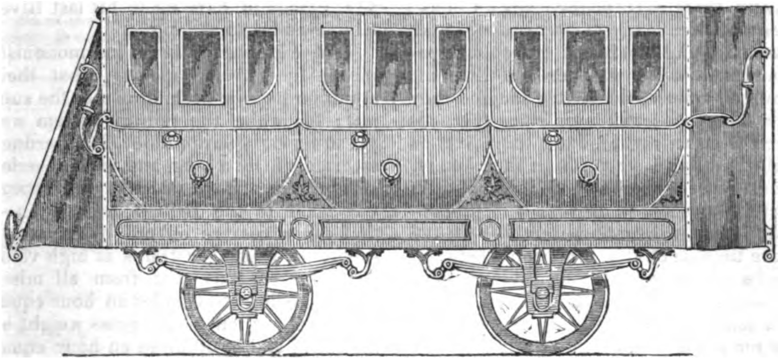


Fig. 2.

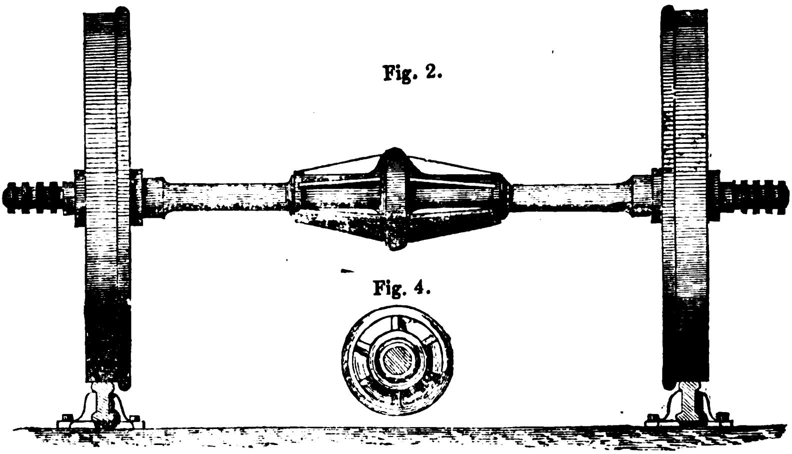
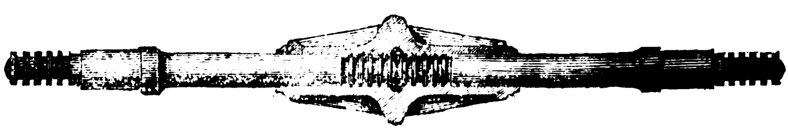


Fig. 4.

Fig. 3.



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BESSEMER'S AIR-DEFLECTING RAILWAY CARRIAGES AND COMPOUND RAILWAY CARRIAGE-AXLES.

Fig. 5.

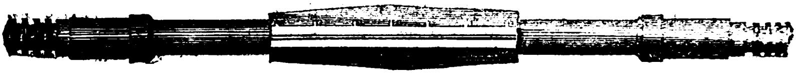

Fig. 6.

Many years have elapsed since Colonel Beaufoy practically demonstrated, by an extensive and diversified series of experiments, that the sharper and finer the bows of vessels, the better adapted they are for speed; and ever since (perhaps even from an earlier date) improvers in ship-building have made it their study, where speed was the object sought, to increase the length of vessels in proportion to their beam; observing, at the same time, such due proportion between the two dimensions as a regard to stability requires. But while the efficacy of fine and acute lines in obviating resistance to the motion of bodies through water and air, have been thus universally recognized, a system perfectly the reverse has been followed in the construction of vehicles for travelling on land, or through air alone. The wagon is broad—the mail-coach, though narrower, is yet square—and the railway carriage is about as broad as the wagon—but such a thing as a sharp-pointed or wedge-shaped land carriage is unknown. Wherefore should this be? The air is but a fluid, like water, only not so dense, and subject to the same laws. It resists the passage of solid bodies through it, precisely in the same way as water resists, only in a less degree. Clearly there is no reason, in the nature of things, why land carriages should not, as well as packet ships, be so constructed as to cleave through the particular fluid which they have to encounter with the least resistance possible; and much reason, in the prodigious speed at which railway carriages are driven (since the resistance of fluids increases with the square of the velocity), for paying more attention to their *lines* than has ever yet been done. To make a railway carriage, intended to travel at the rate of fifty miles an hour, with a broad and square front, is, both theoretically and practically, just as great an absurdity as it would have been in Mr. Ditchburn or Mr. Pascoe to have made his last River clipper as broad as long.

Nor can our railway locomotionists plead, by way of apology, that their attention has not been drawn to the subject; for while the railway system was yet in its early days (1838), Dr. Lardner ascertained, by a long and careful series of experiments—of which a full report was made to the British Association—that the resistance offered by the atmosphere to passenger trains at high velocities far exceeds that from all other sources, being at 30 miles an hour equal to 15 lbs. per ton of the gross weight of the train, and at 60 miles an hour equal to 60 lbs. per ton, while the resistance in both cases from other sources amounts only to 10 lbs. per ton.

Several years later, Mr. Robert Stephenson—than whom no man exercises a larger influence in railway matters—expressed, in his "Report on the Atmospheric Railway," his unqualified assent to the statements of Dr. Lardner.

It appears from a pamphlet before us,* by the ingenious Mr. Bessemer, that about two years ago that gentleman, without being aware of the experiments of Dr. Lardner, instituted a series of experiments of his own, having for their object to ascertain, *first*, what is the amount of resistance offered by the atmosphere to trains of carriages, as at present constructed and connected together; and *second*, how much that resistance would be diminished by filling up the spaces between them. His experiments were brought by an accident to an abrupt termination; but, as far as they went, they demonstrated this much—"That the reresistance of the atmosphere to railway trains is exerted on the ends of each of the

* "On the Resistance of the Atmosphere to Railway Trains, and a Means of Lessening the Same, together with an Account of some Improvements in Railway Carriage-axles. By H. Bessemer, C. E. 16 pp. 4to. With Two Plates. Weale."

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carriages forming a train, and amounts in each case to $\frac{4}{10}$ of the power exerted on the first; and also that, by filling the intermediate spaces between the carriages, this pressure on them would be most materially diminished." Taking this result for his basis, Mr. Bessemer has constructed the following Tables, in order to show the saving of power which would be effected at different velocities by filling up the intermediate spaces:—

Table A.

Showing the resistance of 3 trains moving at 30 miles per hour according to the formula of Dr. Lardner, with the amount of saving deduced from my own experiments.

No. of carriages in each train.	Gross weight in tons.	Resistance of friction 10 lbs. per ton of gross load.	Resistance of the atmosphere 15 lbs. per ton of gross load.	Total retarding force by present mode of working.	Diminution of resistance on intermediate carriages.	Total resistance on new mode of working.
10	40	400	600	1000	470	53
15	60	600	900	1500	767	733
20	80	800	1200	2000	1060	940

Table B.

Showing the resistance of 3 trains moving at 35 miles per hour according to the formula adopted by Mr. Robert Stephenson.

No. of carriages in each train.	Gross weight in tons.	Resistance of friction 10 lbs. per ton of gross load.	Resistance of the atmosphere 20 lbs. per ton of gross load.	Total retarding force by present mode of working.	Diminution of resistance on intermediate carriages.	Total resistance on new mode of working.
10	40	400	800	1200	626	574
15	60	600	1200	1800	1019	781
20	80	800	1600	2400	1414	986

Table C.

Showing the resistance of express trains at 60 miles per hour, assuming the atmospheric resistance to increase as the square of its velocity.

No. of carriages in each train.	Gross weight in tons.	Resistence of friction 10 lbs. per ton of gross load.	Resistrnce of the atmosphere 60 lbs. per ton of gross load.	Total retarding force by present mode of working.	Diminution of resistance on intermediate carriages.	Total resistance on new mode of working.
10	40	400	2400	2800	1878	922

From these Tables it will be seen that high velocities may be obtained without any great increase of power, provided the atmospheric resistance be reduced in the way proposed. For example, in Table A, the total resistance of ten carriages, moving at 30 miles per hour, is, according to the present mode of working, 1000 lbs.; and by Table B we find that twenty carriages at 35 miles per hour will, by the new mode, require a force of no more than 986 lbs.; being 14 lbs. less for 20 carriages at 35 miles, than is now required for 10 carriages at 30 miles per hour.

Again, by Table A, we find that 10 carriages, moving at 30 miles per hour, require a force of 1000 lbs. by the old mode of working; and by Table C, that 10 carriages, moving at the rate of 60 miles per hour, only requires a force of 922 lbs.; showing that by my mode of working, a train of 10 carriages, moving at 60 miles per hour, requires a tractive force less by 78 lbs. than is now required to move the same train at 30 miles per hour.

In order to turn these facts to practical account, Mr. Bessemer proposes that

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railway carriages should be constructed in the manner represented in fig. 1 of the accompanying engravings, and thus described:—

"I have constructed a hood or covering of leather, gutta percha, or any other like flexible and durable material, similar to the hood of a britska or hooded chaise. The frame of this hood is attached by hinges to the projecting head of the buffer, and properly strengthened from within by diagonal braces. The upper part may be moved up or down on carriage-head cranks, and with suitable springs, made to assume either an erect or a sloping position, so that when the carriages are not used, the head may be thrown back, as shown on the left-hand side of fig. 1. But when several such carriages are required to form a train, they are first connected in the usual manner, and the carriage-hoods then thrown up, as shown on the right-hand side of fig. 1. As the hoods each project exactly as far as the end of the buffers, they thus come in contact with each other, and being attached to the buffers, they yield to any pressure of the carriages, while by means of the crank-head levers and springs, they will reach and keep continually the spaces between the carriages closed, whatever may be the position of the buffers, and so prevent the atmosphere from acting on the ends of the carriages. The train is at the same time provided behind with a pointed or wedge-shaped carriage.

"In order still further to carry out the principle of diminishing the atmospheric resistance, I also cover with thin sheet metal or other suitable material, the entire under surface of the carriage frames, and thus prevent any obstruction from the transverse portions of the framing, and various parts which project below the carriage. The importance of this will be easily appreciated when it is remembered that every square foot of surface at 30 miles per hour offers a resistance of 4·5 lbs., so that if we take the opposing surface of cross-bars, &c., on the under side of a carriage at 18 superficial feet, and again reduce this to half the superficial area, on account of one cross-bar being slightly screened by the other, we shall have still 9 feet at 4·5 lbs. per foot = 40 lbs. resistance. Now, taking the resistance at 10 lbs. per ton, we have here an opposing force equal to a load of 4 tons, or about the entire weight of a first-class carriage and passengers."

The adoption of this very rational plan of lessening the expense of working railways, involves luckily neither much trouble nor much expense, and but a few weeks would suffice to introduce it even on the most extensive lines.

Mr. Bessemer makes a good hit, in passing, at the preposterous practice of heaping luggage on the roofs of carriages:—

"Take, for example, a portmanteau three feet in length by one foot high, presenting a surface of 3 superficial feet: at thirty miles per hour this gives a resistance of 13·5 lbs., and assuming, as before (which is really more than ample), that 10 lbs. will draw a ton, we have a resistance caused by this single portmanteau equal to a weight of 2,880 lbs. inside the carriage! And if we apply this rule to express trains moving at 60 miles per hour, the resistance increasing as the square of the velocity, we have $2880 - 2 \times 2{\cdot}11520$ lbs., or little more than 5 tons as the equivalent load inside the carriage. According to the method I have proposed, of closing up the spaces between the carriages by elastic hoods, these will form convenient space for the stowage of luggage, and where they would be secure from rain or dust."

Mr. Bessemer's pamphlet includes also a description of a new railway axle of his invention, of which we are inclined to think very highly. We shall give this part of his production entire:—

"Much difference of opinion seems to prevail among scientific men as to the causes which produce the remarkable changes of quality observed in the wrought-iron axles of railway carriages, and numerous have been the investigations and speculations to which it has given rise. No very satisfactory conclusion has, I believe, been arrived at. That the results are due to vibration disturbing the molecular arrangement of the particles, appears to be the most generally received opinion. But when we compare the state of vibration to which railway axles are exposed, with those of a London omnibus, the correctness of the hypothesis may well be questioned. Let us examine the two cases. The railway axle has a wheel keyed firmly on to each end, is turned truly cylindrical, and rolls over a level and smooth rail of iron, and meets with only a slight shock every 12 or 15 feet, where the rails are joined imperfectly. The axle of the omnibus, on the other hand, has a wheel loose on each end; the wheels are never perfectly cylindrical, and run some twelve hours per day over the uneven surfaces of granite blocks, which cause at every six or eight inches a violent concussion. If we suppose the vehicle to travel ten miles per hour, or 293 yards per minute, and assume the distance apart of

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the courses of granite to be eight inches, we have 1318 concussions per minute, each producing a fresh series of rapid and powerful vibrations, before those caused by the preceding concussion have ceased. Yet, notwithstanding all these disturbing causes, the omnibus axle goes on year after year, and we never hear of the iron having lost its fibre or become crystallized, either from vibration, electricity, or any other of the causes that have been assigned as the destroying agents in the case of railway axles. How is this? When moving at a velocity of thirty miles per hour, the movements from side to side of the railway carriage follow each other in such rapid succession, that the effect seems to the traveller to be a succession of oscillations from side to side, rather than the actual undulations of a carriage travelling in a waved line. But let us examine the consequences of this oscillatory motion. First, it is clear that the crossing from side to side of the wheels must bring the flanges of the wheels in forcible contact with the side of the rails, since the direction given to the wheels is such as would speedily take the carriage off the rail but for the opposition offered by the flanges, and this grinding motion of the flanges is constantly taking place on either side alternately. Secondly, the wheel on one side having a constant tendency to revolve either faster or slower than the other, a strain or twist is given to the axle, first in one direction and then in the other; and when the elasticity of the metal has allowed as much movement as possible of the wheel, the rest is made up by slipping upon the rail. Nor is this all, for in a space of time varying from one second to half a second, the same torsion is exerted in an opposite direction, in consequence of the wheels having reversed their running diameters. It is to this violent torsion of the axle taking place in opposite directions, probably not less than 5000 times in an hour, that I ascribe the alteration in the structure of the iron, and its transition from the fibrous to the crystalline state. The motion is precisely analogous to that which we commonly employ to break tough substances, whether it be the twisting of a wire or the bending a stick backwards and forwards. The object and end are the same: the material having been subjected to a twist or bend, a little above the point of elasticity, for a certain number of times in opposite directions, the substance gives way.

"In order to obviate the numerous defects thus arising from the present modes of constructing and using axles, I divide the axle in the centre into two equal parts, which I reconnect by a coupling-box of a peculiar construction, which, while it allows each portion of the axle and wheel to revolve freely and independently of the other, prevents the possibility of the two parts separating from each other. Two varieties of this axle and coupling are shown in the annexed engravings. Fig. 2 is an elevation of one form as seen when in use; fig. 3 a section of the coupling-box, showing the two parts of the axle with the wheels removed; and fig. 4 is an end view of the coupling-box. Every axle already in use may, at a trifling cost, be altered to this plan by turning a number of concentric rings on each side of the centre, and then dividing it. The two parts are then to be put into a proper mould, and the coupling cast upon them in the same way as is generally practised in casting gun metal boxes on the screws of fly-presses. Where this has been done, the metal occupying the grooves, turned in the ends of the axle, will act somewhat like the threads of a screw, and prevent the parts from being withdrawn from the coupling, but, unlike the screw, the threads being concentric and not spiral, the revolving of the axle will not extricate the two parts of the axle from the coupling. Should wrought iron be preferred as a material for the coupling-box, it may be constructed in two halves and bolted together, and the inside truly bored out, leaving projecting rings or threads to fit into the threads formed, as before described, on the ends of each portion of the axle. An axle constructed on this plan is represented in figs. 5 and 6. Fig. 6 is an end view, and fig. 5 a longitudinal elevation, of the axle and coupling-box, the end of the axle outside the wheel being the part which supports the weight. It will be evident that the centre of the axle must be the point where there will be less strain than any other, but there will be no difficulty in making the coupling-box of such strength that the axle will be stronger with it than without it. As to the possibility of its coming out endwise, no person who has witnessed the enormous strains to which the screw-boxes of presses are constantly subjected, will be under any apprehension on that score. At the same time, the length and tightness of the coupling-box may be such as not to admit of any shake or unsteadiness. It must be always borne in mind that where the wheels are of equal diameter on a straight line of rails, no movement whatever will take place within the coupling, but the two parts of the axle will keep time with each other, the coupling revolving with them; and though, when passing round a curve, the outer wheel, having to travel over a longer space than the inner one, will make some two or three revolutions more than the

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other, yet the axle within the coupling will make these two or three revolutions, instead of the wheel having to slip two or three times round upon the rail. Again, when travelling over a straight line of rails, suppose the wind to blow on the left side of the train, then the carriages will run on the right side of the rail with the right wheel running on its largest diameter and the left on its smallest, which will cause the right wheel to make fewer revolutions than the other—the numbers being in exact proportion to their respective rolling diameters: but there will be no tendency to cross to the opposite side of the rails, and therefore no oscillation of the carriage and slipping of the wheels upon the rails, because the coupling of the axle admits of the difference of velocity of each wheel, so as to suit the required speed of each, whether moving on a curved or straight line.*

"It may be said that the cone on the wheel, as at present constructed, obviates any difficulty in passing round a curve, by the difference of the running diameters of the inner and outer wheels, and that the objection I make is therefore without foundation. If all the curves on a line of railway were of the same radius, and the cone of the wheel accurately calculated to suit them, then I would admit such to be the case; but the fact is notoriously the reverse. However, in all cases where an experimental test can be easily had recourse to, I would rather depend upon it than on the most astute reasoning. I would, therefore, in this case, suggest the following plan as one calculated at once to settle the point as to the amount of torsion of the axle: Take an axle from any of the present carriages; turn the concentric rings before described round the central part of it, and in the centre make it much thinner than any where else—say, for example, 1½ inch diameter. Let the wrought iron coupling-box, shown in fig. 1, be then fitted on in the manner before described, so as to render it perfectly safe in case the axle breaks. Within the coupling there will be no vertical bending or cross-strain of the parts, but there may be a twist round, or torsion produced. While this axle is in the course of trial, let the carriage at the end of every journey be lifted with a jack, to see whether such twisting or torsion has taken place, which may readily be ascertained by trying to turn the wheels in an opposite direction. Should any twisting be observable, then another axle might be tried with the central part left stronger; and so on until the limit of strength for a week's wear was arrived at, which would give a pretty correct idea of the amount of strain to which axles are exposed. It must always be kept in mind that, were it not for the wheels acting in opposition to each other, the central part might be reduced to the diameter of a mere wire, and yet work for years without disruption, in consequence of the protection afforded it by the coupling box.

The advantages proposed by the use of the axle coupling are—*first*, an entire prevention of the alteration in quality of the axles by torsion, and consequently greatly increased safety; *second*, a considerable saving in power now absorbed by the friction of flanges, and constant slipping of the wheels upon the rails; *third*, reduction of wear of the wheels and rails; and *fourth*, an entire prevention of the oscillating motion so exceedingly unpleasant to passengers.

"I would, in conclusion, remark that all axles at present in use may be easily fitted with this coupling at a very small cost and in a little time."

* I would here observe, that the coupling of the form last described might be bolted together so firmly that it would serve as a friction-clutch to prevent the independent motion of the wheels, and keep up the present mode of action precisely under ordinary circumstances, but be still capable of yielding whenever any violent strain was thrown upon it likely to injure the axle. It would thus form a sort of safety-valve, if I may use the expression, whereby the twisting or fracture of the axle would be prevented.

COMPENDIOUS CALCULATION.

Sir,—in a paper on Compendious Calculation (No. 1231, page 243), I promised to mention some curious properties of a certain decimal expression. I now redeem my pledge.

Let it be required to find a number of six figures, such that the same figures being written down in five succeeding lines in the following order,

$$\begin{array}{cccccc} a & b & c & d & e & f \\ b & c & d & e & f & a \\ c & d & e & f & a & b \\ d & e & f & a & b & c \\ e & f & a & b & c & d \\ f & a & b & c & d & e \end{array}$$

the five succeeding rows shall be the five lowest integer multiples of the first.

The first figure of the first line of figures in this case must be *unit* (a). For if it were a larger integer, it would make (when multiplied by 5 or 6, necessarily two of the multipliers) a line of seven figures, which are inadmissible by the question,

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Unit, being the first figure of the *first* line, must, by the conditions of the question, be the last figure of the *second*.

1 . . . . .
. 1

Among the required multipliers 2, 3, 4, 5, 6, the only factor which will produce 1, when multiplied into another, is 3, and that when multiplied into 7. We have thus obtained the first multiplier, namely 3, and the last figure of the first line, namely, 7 (f); which must also be the last figure but one of the second line by the question.

1 7
. . . . 7 1

As our multiplier is 3, and two is carried from the product of 7 by 3, the next figure in the upper line necessary to product 7 in the line immediately below is 5 (e), which also becomes the last figure but two of the second line by the question,

1 . . . 5 7
. . . 5 7 1

Proceeding thus, we complete the first and second row of figures.

1	4	2	8	5	7
4	2	8	5	7	1

And here we have the decimal of $\frac{1}{7}$. The other properties of this decimal expression, besides the singular mode of its generation, it is worth while to observe.

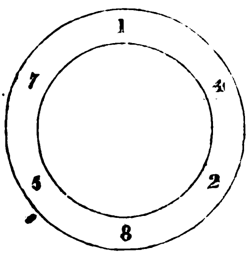
First, the second line, which is a multiple of the first, has its figures in the order required.

a	b	c	d	e	f
b	c	d	e	f	a
1	4	2	8	5	7
4	2	8	5	7	1

Secondly, if we write down the other lines in the prescribed order we shall find them multiples of the first.

1	4	2	8	5	7		a,	b,	c,	d,	e,	f,
4	2	8	5	7	1		b,	c,	d,	e,	f,	a,
2	8	5	7	1	4		c,	d,	e,	f,	a,	b,
8	5	7	1	4	2	or	d,	e,	f,	a,	b,	c,
5	7	1	4	2	8		e,	f,	a,	b,	c,	d,
7	1	4	2	8	5		f,	a,	b,	c,	d,	e.

Thirdly, in every multiple, any given figure is followed by the same figure; so that if we form a circle with the figures ranged round, we may begin where we like, and, making one revolution, we shall have the decimal of $\frac{1}{7}$, or a multiple of it.



·1	4	2	8	5	7
·7	1	4	2	8	5
·8	5	7	1	4	2
·4	2	8	5	7	1
·2	8	5	7	1	4
2·4	2	8	5	6	9

Of this property, which makes the several multiples easily recognised and remembered, some advantage may be taken by those who teach the elements of arithmetic for abridging their own labour. The operation of simple addition does not require much abridgment, but any saving of time and trouble is not to be despised by those who have a great deal to do. If the master gives the pupil some multiples of $\frac{1}{7}$ to add, he may know at once what the total must be, merely by summing up the sevenths, as in the following example:

$$\frac{1+5+6+3+2}{7}=\frac{17}{7}=2\frac{3}{7}=$$
$$2{\cdot}428571-2=2{\cdot}428569$$

If a dozen or even a score lines were given, the trouble of adding or inspecting them would be nearly the same for the master as that of summing up the smaller number of them. It will not escape the notice of the intelligent reader that the decimal expression ·142857 is not, as I have mentioned

before, precisely equal to the vulgar fraction $\frac{1}{7}$. Therefore a correction is to be made as in the case above.

In *multiplication* the saving of trouble to the teacher is more considerable by the use of this decimal. Every line of the operation is at once known to him without calculation. The least mistake is detected at once, not only in the product, but in the body of the sum; so that he can immediately point out where the error lies. This will appear on a momentary inspection of the following example:

$$\begin{array}{r} 142857 \\ 6432 \\ \hline 285714 \\ 428571 \\ 571428 \\ 857142 \\ \hline 918856224 \end{array}$$

$$\frac{6432{\cdot}000000}{7} = 918{\cdot}857142$$

From which substract for correction $\quad {\cdot}000918$

$$\begin{array}{r} \hline 918{\cdot}856224 \end{array}$$

A Scottish schoolmaster once told me that without the aid of the decimal of the seventh, he could not have got through his work. He had a large class of young persons to instruct in arithmetic, and his time was limited to two hours in each day for that purpose.

In division also, the multiplication and the result may be examined with much less trouble. We must of course remember that when the multiplier is more than 7, a correction must be made, as will be easily seen in the following operation:

$$\begin{array}{l} 142857)3694568943(258 \text{ \&c.} \\ 285714 \\ \overline{{\cdot}837428} \\ 714285 \\ \overline{1231439} \\ 1142856^{*} \qquad {}^{*}6, \text{ Correction instead of } 7. \\ \overline{\,{\cdot}\,{\cdot}\,88583 \text{ \&c.}} \end{array}$$

I need not finish the operation, to show that the multiplications are all examined by a glance. The result, or quotient, may be shortly determined as before explained. The rule is—multiply the dividend by 7, and compensate the defect of the decimal expression ·142857 by adding to the product, *itself divided by a million.* It may be analysed thus:

$$\frac{3694568943}{142857} = \frac{3694{\cdot}568943}{{\cdot}142857} = \frac{3694{\cdot}568943}{\left\{\frac{1}{7} - \frac{{\cdot}000001}{7}\right\}} =$$

$$\overline{3694{\cdot}568943 \times 7 + 3694{\cdot}568943 \times {\cdot}000007} \quad =$$

$$25861{\cdot}982601 + {\cdot}0258619\ldots = 25862{\cdot}008\ldots.$$

I purpose to offer you in my next communication, some observations which may throw a new light on the construction of magic squares; another subject as yet, I am sorry to say, of barren speculation. But perhaps not always to remain so. In reference to this subject, I sometimes think of the time spent on the conic sections by the ancients long before they were turned to practical account. Wallace's remarks on this circumstance are well worthy of consideration: "Among the ancients the study of the conic sections was a subject of pure intellectual speculation. The applications of the properties of these curves in natural philosophy, have in modern times given to this part of the mathematics a degree of importance that it did not formerly possess. That which in former times might be considered as interesting only to the learned theorist and profound mathematician, is now a necessary attainment to him who would not be ignorant of those discoveries which do the greatest honour to the present age."

It is curious to remark in the progress

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of discovery the connection that subsists between the different branches of human knowledge; and it excites admiration to reflect that the astronomical discoveries of Kepler, and the sublime theory of Newton, depend on the seemingly barren speculations of Greek geometers concerning the sections of the cone."—*Wallace's Conic Sect. Introd.*

J.

BALLAST-SHIFTING APPARATUS.

Sir,—Decked boats are not permitted to use shifting ballast when they compete in sailing matches; but it may be employed with great advantage by smaller boats, such as those managed by one or two hands. Most of the fishing luggers in the South of England are furnished with it; and if it could be rendered more convenient and less dangerous in its application, it would be generally used when speed or the carrying of much canvas is a desideratum. The chief inconvenience and danger occurring on the shifting of dead weight on every tack, is caused when the sails are taken aback at any time; for then both gravity and the force of the wind concur in oversetting the boat.

I propose to remedy this evil by a contrivance which shall enable us to shift the ballast instantaneously, and which, at the same time, is neither cumbersome nor expensive, while the force is applied to the greatest mechanical advantage.

The chief object in the use of ballast is to impart stability, or "*stiffness*,"—and for this end we must so apply its weight, that when the boat heels over, there shall be the greatest possible distance between the verticals through the mean metacentre of the boat and the centre of gravity of the boat and ballast. This may be effected either by lowering the additional weight, or by altering its horizontal position. The apparatus which I shall now describe is intended to perform the second of these movements.

Fig. 1 is a side view, and fig. 2 a view from the stern of the whole construction.

Fig. 1.

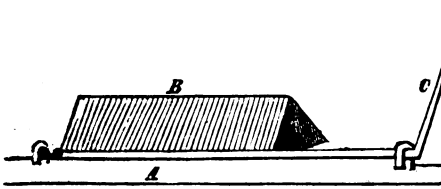
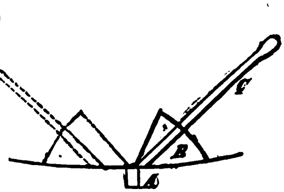


Fig. 2.



A is the keel of the boat; B a prism of cast-iron, of the requisite weight, to which is attached a bar, which turns in two holdfasts fixed in the keel. The after end of this bar is bent at right angles, forming the handle C. The section of the prism being an equilateral triangle, fig. 2 represents its two positions according as the boat sails on the *port* or *starboard* tack.

The handle C, when vertical, should touch the foremost edge of the thwart on which the steerer sits, if there be but one person in the boat, and should project six inches above this thwart: this will enable the sailor to shift the ballast either by his leg, or by a momentary application of one hand.

If there be two persons in the boat, the handle may be placed so as to be in a similar position with respect to the thwart occupied by the second person. It will be seen that about one-third of the weight of stationary ballast will suffice when applied in this manner. And if it be required to trim the boat on an even keel (as for instance when not sailing), we have only to place a *chock* under each side of the iron prism, and keep it in the centre. Supposing the prism to be of the weight of $1\frac{1}{2}$ cwt., and the lever two feet long, a power of 14 lbs., applied at its extremity, will be sufficient to move it.

I had thought of a pedal lever, to be worked by each foot alternately; but, upon consideration, the above method appeared an improvement.

As I am confident of the feasibility of this construction, I should be obliged if you would give it a place in your Magazine, unless its claims to novelty have

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been forestalled, or rendered superfluous by better means of attaining the same ends.

I am, Sir, yours, &c.,
JOHN M'GREGOR.

Battersea, May 24, 1847.

LIQUID BARM, OR YEAST.

The following will be found an excellent recipe, by which bakers and others may manufacture their own yeast, in an expeditious and economical manner:—Take one pound of the Patent Concentrated Extract of Malt and Hops, and mix it well in one gallon of boiling-hot water; allow it to cool to 70° or 80°, and then add half-a-pint of common brewers' yeast. Now lay it aside to ferment. In twelve or fourteen hours it will be ready for immediate use, after rousing it well up; or it may be bottled, tying a piece of cloth over the neck, instead of using a cork. In a cool place, it will keep perfectly good a week or more. The liquid yeast thus prepared makes excellent bread, it does not cost half what is usually bought by the baker, and gives the bread a degree of tenacity not obtained from other yeast. One gallon, made as recommended, will raise two sacks of flour of twelve score each, equal to about one and a half sacks of flour in London. It will raise fully this quantity, or rather more, being sufficient for as much flour as would require 6 lbs. of the ordinary barm or yeast.—*From a Correspondent.*

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

No. 6 (a)—VALUES OF SYMBOLS—SYMMETRIC PRODUCTS — BIQUADRATIC EQUATIONS.

The following problem will serve to show the utility of keeping in view the symbolical as well as the arithmetical meaning of the expressions which occur in analysis. Suppose that it is required to find two numbers such that their sum shall be equal to 4, and the sum of their fourth powers to 82 (*b*). The solution of this problem may be made to depend upon that of the quadratic (*c*),

$$(xy)^2 - 32xy = -87,$$

which gives

$$(xy-16)^2 = (-16)^2 - 87 = (-13)^2;$$

for, in taking the difference 256—87, or rather $(-1)^2 256 - (\pm 1)^2 87$, we must not alter the symbolical affection of the greater number; hence we obtain by evolution

$$xy - 16 = -13, \text{ or } xy = 3,$$

which conducts us to the required solution. Had we given to 13 the double sign ($\pm$) we should have obtained for xy the value 29 as well as 3. But the former value leads to an unreal result (*d*). In the present case, then, by a scrutiny of our symbols, we have been able to seize upon the *real* solution; in a former instance (*e*) we were enabled to exclude an *ambiguous* one; and I am not sure that in the example quoted in note (*k*) page 492 we might not *à priori* have pronounced 3 to be the true answer to the question, on the ground that, *arithmetically speaking*, the number 6, considered as equivalent to

$$\left(\frac{5}{2}\right)^2 - \left(\frac{1}{2}\right)^2$$

must be taken to have resulted from taking the difference of the squares of *positive* quantities. This is, however, merely a casual remark thrown out with reference to the particular case. I need not reiterate that, whenever we know that a positive number has originated in squaring a negative one, we must bear that origin in mind,—that is to say, whenever it becomes material, for in the problem above discussed, it would be palpably useless to inquire into the origin of the "87," since, whatever its symbolical affection, such affection is merged in that of the greater number into which the 87 is absorbed, or, rather, by which it is neutralized.

Should I be asked "Whether we can, in *all* cases, by a consideration of the symbols, distinguish the desired result?" My reply would be,—In many cases the considerations above dwelt upon would enable us to select appropriate solutions; but any rules that we could frame from the foregoing observations, would rather be safe tests of the *admissibility* of results than unerring criteria of the *in-*

(*a*) No 5 will be found *ante*, page 490.

(*b*) See Kelland's *Algebra* (1839) page 140, Art. 61, Ex. 1.

(*c*) Ibid. page 141.

(*d*) Ibid.

(*e*) *Ante*, page 491, right-hand column.

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admissibility of the expressions not included in those results. Such rules would form safe reasons for the *admission* though not for the *exclusion* of formulæ. The important subject of the discrimination of the useful from the useless solutions of a question—of the separation of the values arising from elimination, &c., from those which alone belong intrinsically to the problem—requires considerations more extended than those which we have yet employed. One object of such discrimination will evidently be to ascertain *all* the true solutions; at least, until we can do this the subject cannot be said to be perfected. By way of illustration, let it be required to solve the following problem (*e e*):

"Sold a horse for 24*l.*, and by so doing lost as much per cent. as the horse cost me: required the prime cost of the horse?"

Here, (x being the cost in pounds),

$$\frac{x-24}{x}=\frac{x}{100},$$

whence

$$x^2-100x=-2400,$$

and

$$x=50\pm10=40 \text{ or } 60.$$

The principles on which we have hitherto proceeded would indicate 40 as the value which we ought to employ,—and accordingly we find that it satisfies the conditions of the problem proposed. But so does the other value "60." Here then is a new case; the excluded value is perfectly admissible.

Without in the present note dwelling farther upon this, I now propose to offer a few additional remarks on the *method of symmetric products*, and to point out its application to the solution of biquadratic equations. Retaining, then, the notation of No. 5 (*f*), it will be found that

$$a=-1,\ b=1,\ l=-1$$

are values of a, b, and l, which satisfy the conditions of symmetry; let

$$y=P+Qx+x^2,$$

then it will also be found that the expression $\pi(y)$ is free from P; in other words $\pi(y)$ is a CRITICAL (*ff*) function, and P disappears from it (*g*). We are, then, at liberty to determine P so as to satisfy other conditions. Give it such a value as that A' shall be zero, and we shall then have the following equations for determining y_1, &c.,

$$y_1-y_2+y_3-y_4=0 \ldots\ldots (1)$$

$$y_1+y_2+y_3+y_4=0 \ldots\ldots (2)$$

$$y_1y_2+y_1y_3+\&c.+y_2y_3+\&c.=B' \ldots (3)$$

$$y_1y_2y_3+y_1y_2y_4+\&c.=0,\ (h) \ldots (4).$$

If, by the aid of the first and second of these equations, we eliminate y_3 and y_4 from the last, we shall (since the result will be a homogeneous cubic in y_1 and y_2,) be able to obtain the relation

$$y_1=m\,y_2 \quad \ldots \quad (5)$$

where m will have three values; and by means of (1), (2), and (5), we may reduce (3) to the form of a quadratic involving one of the y's only. And, all the y's having been determined, we may obtain the values of x, the root of the given equation (*i*). I have thought it as well to exhibit the solution in this point of view, in order that it may be clearly seen why the method succeeds in the above case, and also for the sake of analogy, and of comparison with the case already discussed in my last; Note (*j*). For further remarks on this subject see the places cited in the note (*m*) page 492 of the present volume.

I shall trouble your readers to make the following corrections in my last paper. Page 491, 2nd column line 25, *for* 259 *read* 529; 491—second column note (*j*) line 1, *for* (B). *read* (B.); 492

(*e e*) Peacock, *Third Report of British Association*, page 191 note *

(*f*) See *ante* page 492.

(*ff*) See *Phil. Mag.* s. iii., vol. xxviii, p. 191.

(*g*) Referring to the equations (14) and (15) of page 115 of vol i. of the *Mathematician*,

$$(15)+a\times p_1\times(14)=0,$$

will be a critical equation for the values $n=4$, and $a=6$; this last equation becomes, on dividing by 12,

$$8p_3-4p_1p_2+p_1^3=0$$

which is therefore a critical equation. Hence

$$\pi(y)=-8C'+4A'B'-A'^3=0$$

is, in like manner, a critical equation. By a critical function of a quantity I mean a function from which the quantity vanishes. In the present case "critical function" or "critical equation" means a critical function of, or a critical equation in, P.—J. C.

(*h*) From the last equation of the preceding note (*g*), it is easy to see that, when $A'=0$, C' also is equal to zero.—J. C.

(*i*) See a note connected with this subject, at pages 36—39 of Jerrard's *Mathematical Researches*. —J. C.

(*j*) Vide *ante* page 492 columns 1—2.

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first column line 18, omit the comma; 492, second column line 7 *for* or, 4 *read* or 4,

I am, Sir, yours, &c.,
JAMES COCKLE.

2, Church-yard-court, Temple,
May 22, 1847.

MR. JACOB BRETT'S ELECTRIC PRINTING TELEGRAPH.

Sir,—I have read with much interest, but I must confess with some little scepticism, the account of Mr. Brett's telegraph in your journal, No. 1240. Some of the statements are so surprising to one, who, like myself, cannot quite follow the telegraph at its own, or at least its *reputed* speed, that I trust you will allow me to request a further elucidation of some parts, which appear to me indistinctly expressed. In order to render myself more clear, I will class my remarks under the heads of the several "objections," to which they refer.

1st. Is it true that Messrs. Cooke and Wheatstone cannot work a telegraph with a single wire? I surely saw one of this description on the South Eastern Line, last autumn. Nay, if I err not, there was a *Printing Telegraph,* which to unpractised eyes like mine, was a second Dromio to that of Mr. Brett's, working between Slough and Paddington, at about the same rate per minute also, nearly if not quite four years ago.

3rd and 4th. If Mr. Brett's wires were laid underground, would not any injury, whether from the pick and spade of a mischievous "Navie," or from the subsidence of an embankment, be at least as difficult to discover and rectify as an accident to a suspended wire, where the whole is above ground and visible?

5th. What are the "Hydrostatic and Pneumatic Agencies," employed by Mr. Brett as his "*motive* powers?"

8th. I should hardly have supposed that this objection could have been very weighty, judging from the ease, rapidity, and certainty, with which I have seen messages and answers succeed one another at the telegraphs in some of the railway stations.

9th. It appears to me that the acknowledgment of each word as understood, would add much to the security and certainty of the communication, and the time thus lost is surely very small. Would Mr. French however prefer having all the words sent uninterruptedly, without knowing whether the distant instrument acted in exact concordance with the communicator's apparatus or not? If the machine were *absolutely infallible,* this would be all very well, but is this the case?

10th and 11th. There appears to be some contradiction in these two objections. If the intermediate stations are *not* to read the messages, surely the tenth objection falls to the ground. If they are to read the messages, the eleventh seems to me unnecessary. I am not myself sufficiently versed in telegraphic matters to see the necessity for a message which is intended for one station only, being registered at all. Can Mr. French, however, inform your readers of the means employed by Mr. Brett to select any one out of a number of stations, as the recipient of a message, and to leave the rest unconscious of such message? To do this, and to print the message, with a single wire, I must say is incomprehensible to me.

12th. Where has Mr. Brett's telegraph been tried between stations "340 miles apart?" Surely not in England, as there is no line of telegraph of that length, that I can find. In America, Professor Morse mentions only one line so long.

I almost fancy there must be some misconception on one or other side, as to the length of the lines completed by Mr. Brett, in America. At the latter end of 1846, Professor Morse stated, that he had in America 1,659 miles of telegraph, but no mention of Mr. Brett's name then appeared. Is it possible that 4,000 miles of telegraph can have been finished by Mr. Brett since that period? The length of railway complete in America, at the commencement of this year, is returned as 4,060 miles, of which Professor Morse having furnished 1,659 miles with *his* telegraph, I am somewhat puzzled to account for the 4,000 miles out of the 2,401 which are left. Will Mr. French therefore favour your readers with the names of the lines completed by Mr. Brett, which will at once clear up this difficulty?

I have only further to beg for a little more enlightenment as to the method in which Mr. Brett prints "from 300 to 3,000 letters per minute." Certainly when I saw his telegraph, although assured it would print 87 letters per minute, yet its performance did not amount to

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quite one-third of that number. I crave pardon for a shade of incredulity as to Mr. French's remarks hereupon.

Mr. French, can doubtless clear up these seeming difficulties, and I have the less hesitation in asking this, as I am sure he is as able and willing to impart, as anxious to acquire knowledge. As an humble admirer of that science in which he has already assumed so high a position, I cannot conclude without expressing my congratulations, on the improvements and inventions which have already originated in his talents and ingenuity.

I am, Sir, your obedient servant,

Tyro-Electricus.

London, May 19, 1847.

THE WOOLWICH EXAMINATIONS.

A word or two on the Woolwich examinations is due from us to our correspondents and readers. We have received several letters relative to our remarks last week (p. 489), but which it would be impossible to print entire. We shall therefore briefly state their substance.

The mathematical examinations are conducted by Professor Christie, from printed papers. Of these he has two or three series, which he is understood to employ in turns. Whatever care may be taken by the professor himself, he cannot prevent the examinee from *remembering* these questions. The masters of the "cramming-schools," whose pupils form the great bulk of those who go up for examination, have thereby obtained possession of the professor's entire series of questions. In the solution of these, the boys are drilled for weeks and months, till they could write them out blindfolded. A near relative of our own has passed through the whole ordeal, and we must be understood not to speak from mere rumours, or from the remarks with which the papers have abounded. It is very easy for the learned examiner to urge, that no one of the candidates had *seen his papers*; and a flimsy put-off, like that in the *Naval and Military Gazette*,* may suit the professor's indolence more easily, than framing a new set of questions for each successive examination. All the boys trained in the Woolwich schools are as familiar with the professor's questions as he is himself. Nay, more, the professor was charged in the same journal with himself preparing a boy for his own examination! This, too, when it was a competition examination for admission into the academy!! Nor are we aware that any explanation was ever offered of so singular a transaction.

Again, it was the custom at one time (not long ago) to employ as *classical examiner*, the master of one of the Blackheath Proprietary Schools. Yet the classical examination extended only to Cæsar's Commentaries, and there were three Cambridge men employed in the institution—one of whom was either in Holy Orders, or a candidate for becoming so! We understand, however, that the newly-appointed chaplain to the academy is hereafter to perform this farce. We call it a farce advisedly, since not an hour is ever given to instruction in Latin, after the candidate becomes a cadet, whilst the amount of knowledge thus required of him, must inevitably and irrecoverably be lost in the first six months. How much more useful would a mastery over the structure of a sentence in pure English be!

But the gravamen of the charge against the Woolwich examinations, fully justifying Mr. Wharton in his explanation of his remark, is this:—

The French, German, and drawing masters of the academy, are all teachers in the "Woolwich examining-schools;" and are at the same time the *only appointed judges of the fitness of all candidates who present themselves for examination!* This may well give rise to dark surmises; although from all we hear of these gentlemen, they are men of strict honour and incapable of a wilful act of injustice. Yet, why are they placed in such a questionable and perilous position? Simply, as we are informed, in conformity with the paltry conditions imposed upon them by the

* "If, contrary to the conviction of every one connected with this institution, *an examination paper has ever been seen* by a candidate or cadet, previous to the questions in that paper being proposed to him at that examination, I can only say that the person who will point out how such a paper has been obtained will confer a great benefit on the institution, for which I shall be ready to tender him my best thanks; and in this sentiment I am satisfied I shall be joined by all who are connected with the institution here." *N. and M. Gazette*, Feb. 18, 1843.

Board of Ordnance,—they are employed upon very small salaries, upon the understanding that their being of the "Royal Military Academy" will gain them sufficient employment as private teachers to enable them to eke out an existence. The mathematical professors, we understand, are precluded from giving private instruction to any cadet (even a friend's son), and likewise any instruction to any one who intends hereafter to become a candidate. *Their* impartiality and honour are hedged in; but any other master belonging to the institution does not need such safeguards of his virtue! Is mathematical science then only a brand of dishonesty? It would really seem to be so esteemed at Woolwich. Yet we think the public would feel more confidence in the perfect fairness of an examination, if it were conducted by persons *totally disinterested in the result;* and a public institution, supported by the public purse and for public objects, ought to so arrange itself as to ensure public confidence, for the fairness and impartiality as well as the ability with which it fulfils its functions.

A good deal of noise was made some months ago, about a "Committee of Officers" which was appointed to investigate the state of the Royal Military Academy, and to report thereon to the Master-General of the Ordnance. Whether that committee be yet sitting, or has concluded its labours, we do not know; but we shall hope to see some of the fruits of so necessary an investigation, and that a system, so unseemly, so derogatory to the dignity of a public institution as this, has not escaped their scrutiny. We trust that some less objectionable means of paying the public servant will be devised: and with these hopes we take our leave of the subject.

"INSTITUTION OF MECHANICAL ENGINEERS."

An institution has been recently established under the above title, which has Birmingham for its head quarters, and has had two or three meetings, the proceedings of which have been duly reported in the local journals. The name is not a very happy one (for what is an "Engineer" of any grade if he be not "mechanical?"), but seems intended to indicate, that the association consists, as is the fact, chiefly, if not wholly, of *Working Engineers*, as contradistinguished from *Civil Engineers*—that is to say, of persons personally engaged in the construction, or working, or immediate superintendence of engines and machinery. But however it is to be regarded—whether as a rival or as an auxiliary to the London Institution of Civil Engineers—it is giving unmistakeable signs of zeal and ability on the part of its members, and of great public and private usefulness. We select, as a specimen of their labours, the following valuable information on the subject of Fanblowers:

The first paper read was by Mr. Buckle, "On the use of the Fan for Manufacturing Purposes." The experiments, which form the subject of this paper, were made for the purpose of ascertaining how the greatest quantity of air could be accumulated with the least possible expenditure of power. The original application of fans was for the purpose of separating and dressing seeds, the speed and density of the air being limited to manual power. But since their application to smitheries and foundries, and steam and other motive power have been used, their speed has been so increased that the density of the air ranges from 3 ozs. to 12 ozs. per square inch. Various forms of fans have been adopted, but the one generally preferred is called an eccentric, with three or six blades or arms radiating from the centre. The pressure of the blast ranges from 4 ozs. to 5 ozs. per square inch, with nozzle tuyeres 1⅝ inch diameter, varying from 1 to 3 inches diameter; but in a well-regulated smithy the nozzle is fitted with nosepipes as ferrules, to suit the quantity of blast required. An eccentric fan 4 feet diameter, the blades of which are 10 inches wide by 14 inches long, and running 870 revolutions per minute, will supply air at a density of 4 ozs. per square inch, to 40 tuyeres of 1⅝ inch diameter each, without any falling off in density. In the first six Experiments no discharge of air takes place, the velocity of the fan merely keeping the air at a fixed density or pressure per square inch due to that velocity. The remaining 26 experiments show the fan discharging air. An inspection of the table shows that under

various conditions of velocity of the tips of the fan, the density of the air and theoretical quantity of the air discharged vary but not in a direct ratio. The greatest quantity of air is discharged by the fan with the least expenditure of power when the tips of the vanes revolve with $9\frac{1}{10}$th of its theoritical velocity. In a recent set of experiments the inlet openings in the sides of the fan-chest were contracted to 12 inches, and 6 inches diameter—the original diameter being $17\frac{1}{2}$ inches. The results obtained were, that with the 12-inch openings, the power expended was $2\frac{1}{2}$ to 1 compared to the openings of $17\frac{1}{2}$ inches—the velocity of fan, the density of air, and the cubic discharge being the same. With the 6-inch opening the same results followed as with the 12 inches, only the density of air decreased one-quarter. These experiments show that the inlet openings must be of sufficient size, that the air may have a free and uninterrupted action in its passage to the blades; for if we at all impede this action, we do so at the expense of power.

The Secretary read another paper, which had been received on the same subject, from Mr. Jones, of the Bridgwater Foundry, Bridgwater; the following is an extract,—

"There is, perhaps, no point upon which mechanics have had a greater variety of opinion than that of the application of the fan for manufacturing and other purposes; nor is there any other subject which has caused more disappointment: and I am decidedly of opinion that this has been principally occasioned by constructing the air-passages too small in the fans, as well as the passages leading to the tuyeres. Facts are always better than opinions; and in offering the following statement, I merely give the result of six months' constant work. Two points of importance in the construction of fans are, an exact balance of the fan upon the axle, and a careful and judicious arrangement for getting up the speed so as to avoid either tight straps, or any slipping up on the pulleys. With this I forward you a drawing of the fans I have constructed. You will perceive that I have made the openings unusually large, but the results have fully justified the proportions. With these two fans we have been melting 50 to 60 tons of iron per day, at the rate of 5 to 6 tons per hour, with a consumption of coke of 208lbs. to the ton of iron; in addition to which there are upwards of 50 smiths' fires blown at the same time. The power required is about eight horses, the motion being taken from a 12-horse power engine by means of a 7-inch gutta percha belt, the shaft running at 73 revolutions per minute. The speed of the fan is about 750. They are driven by a pulley on each end of the spindle. This I think much better than a single strap. The openings at the side of the fans are 2 feet 4 inches in diameter, and the outlets are 24 inches by 12 inches. The passage from the fans is 2 minutes 9 seconds by 1 minute 9 seconds, leading to a reservoir under the cupola 18 minutes 0 seconds by 7 minutes 0 seconds by 4 minutes 0 seconds deep, from which we have two tuyeres 6 inches in diameter. The pressure of blast is $5\frac{1}{4}$ ozs. per inch. The only thing to which I wish to call your attention is, the increased-size of the air passages; and when we consider the large quantity of iron melted, and the small proportion of coke used, the result is very satisfactory."

Mr. Buckle remarked, that his paper had been drawn up for the purpose of recording a course of experiments made during a series of years at his leisure, and which had been executed with the utmost care. The results were important to those who were about to adopt the fan, as teaching them that its size must not be a matter of guess-work. When he himself had a fan made, all the advice he could get was, "Make it big enough." The parties who said so knew nothing about it. Had he been then in possession of the results of his subsequent experiments he should have had his fan made only half its present size. He now found that all that is required is, that the tips of the fan shall revolve with 9-10ths of the theoretical velocity. In driving the fan at that speed they would obtain the largest portion of blast at the least expenditure of power. By driving them at a greater velocity the power was absorbed without producing a greater quantity of blast.

The Chairman, Mr. M'Connel, said, that Mr. Jones's economy of power was very remarkable. He stated, that he

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was working the fan with an engine of 8-horse power, and that the revolutions were about 750 per minute. How did Mr. Buckle's experience agree with that?—Mr. BUCKLE had worked his engine from 700 to 1,500 revolutions per minute, but had recorded only 1,200. Let the size of the fan be what it might, the law was that the tips should only run at a certain velocity. His fan was 3 feet 10 inches and 13-16ths of an inch.

The CHAIRMAN wished to know, if Mr. Buckle had ascertained the relative values of long and short pipes?—Mr. BUCKLE had not had the opportunity of trying that. He had tested the power, having 40 of the holes in the pipe at the further end, and the same at the end next the fan open, and the difference in the effect was so small that it could not be measured. He proposed to go into the subject of the proper length of the pipe in a future paper. The Chairman said the subject was of great interest to himself, as he was about to lay down a number of pipes for the purpose at Wolverton.

Mr. COWPER wished to know if the horse-power mentioned by Mr. Jones was indicated, or commercial horse-power? Was it the same as that meant by Mr. Buckle? Mr. BUCKLE said, he had ascertained the power by a dynanometer, having a spiral spring and a piston attached. Having ascertained the amount indicated by the engine when disconnected with the fan, he had deducted that amount from the amount shown in every experiment. The engine was nominally a 14-horse power engine. He had found that by a succession of fans, the first transmitting the blast to the second, and so on, he obtained by the third or fourth a pressure of 2¼ lbs. on the square inch.

Alderman GEACH remarked, that this plan was in use at a furnace fitted up some three or four months since in Derbyshire, where they proved that they could obtain a pressure of 2¼ lbs. on the square inch, and that they could make better iron, and in a larger quantity, than by the old plan.

Mr. BUCKLE had not been previously aware that the plan had been tried, but he had ascertained that the uniformity of the discharge was greater than that of the blowing cylinder, and the quality of the iron would be better.

Mr. HENDERSON said, that in the works in Scotland with which he was connected they had a fan so badly constructed that they were about to have it altered, which, nevertheless, turned out 220 to 230 tons of casting per week. They had found that they could get something like double indicated power out of the ordinary Fairbairn's engine, compared with what it was sold for. He should like to know the proper form of the fan, the proper length of pipe, and the size of the pipe which conducted the blast from the fan to the place where they wished to use it. In Scotland they were working a shaft 200 feet long; and he should like to know whether they could effect their object by laying down underground piping, instead of having a shaft to conduct the power to near the place where they wished to use it. They had enlarged the tuyere pipe, having ascertained that, in melting iron, the density of the air was not so important as the quantity, and that it was necessary that the air should be admitted in large quantities.

Alderman GEACH knew of one furnace where the cupola was 150 feet from the blast.

Mr. H. SMITH stated some experiments, which went to show, as the Chairman remarked, that, putting the case in an extreme point of view, the further the blast was from the fire the better.

The discussion was then adjourned, to afford an opportunity for further experiments.

RIGHTS OF INVENTORS BY PATENT AND BY REGISTRATION—AND EFFECT OF DISCLOSURE UNDER AN OBLIGATION OF SECRECY.

VICE-CHANCELLOR'S COURT.

(*Before the Vice-Chancellor of England*, SIR LANCELOT SHADWELL, *27th May*, 1847.)

ALFRED BRETT AND GEORGE LITTLE *v.* THE ELECTRIC TELEGRAPH COMPANY AND CHARLES MASSI.

THE plaintiffs, Messrs. Brett and Little, are the inventors and patentees of certain "improvements in telegraphs, and in the arrangements and apparatus to be used therein and therewith; part of which improvements are also applicable to time-keepers and other useful purposes." Their patent is dated 11th of February, 1847, and not yet specified. One portion of their invention consists of a new voltaic battery,

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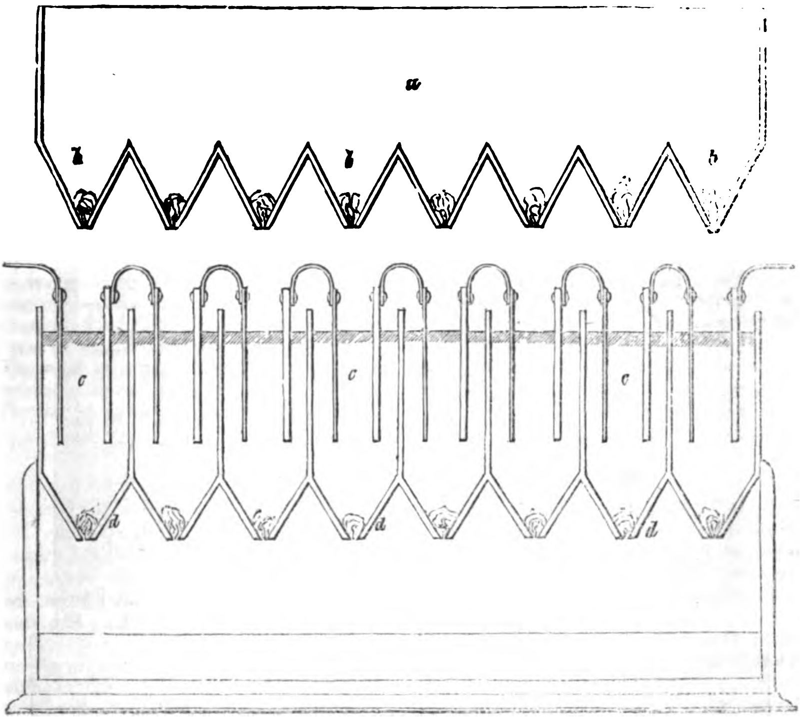
called the "Hydraulic Battery," and it was this portion which formed the subject of the present application to the Court. The defendant, Massi, claims to be the inventor of a battery called the "Percolating Galvanic Trough," which he registered on the 16th of July, *five days after the date of Messrs. Brett and Little's patent*, and the other defendants, "The Electric Telegraph Company," are his employers or patrons. Fig. 1 of the accompanying engravings is a sectional elevation of the plaintiff's battery, and fig. 2 and 3 an external elevation of Massi's. It will be seen at once that they are as nearly as may be identical in construction, and, in point of fact, this was conceded on both sides.

Fig. 1.



Mr. STEWART for the plaintiffs, with whom were Mr. Webster and Mr. Prior, described the Hydraulic Battery, as being constructed so as to maintain a constant and unvarying power, by means of a reservoir (*a*) being placed over the trough or battery (*c*) containing the plates, whence a constant supply of the dilute sulphuric acid, or other exciting liquid, falls drop by drop through small hollow cones (*b b*) into the cells of the trough or battery beneath, which cells are similarly furnished at bottom with small hollow cones, from which, after the sand has become fully saturated, the sulphate of zinc escapes as fast as it is formed. The learned counsel then proceeded at great length to point out the difficulties which the electric telegraphs at present experienced in consequence of the formation of the sulphate of zinc, which adheres to the plates as it forms, and thereby prevents the action of the acid upon the metal; until, at last, the battery becomes nearly powerless, and the working of the telegraphs consequently very uncertain. The advantage of the invention of Messrs. Brett and Little was indisputable; and the object of the present application was, that the Court would grant an injunction to restrain the defendants, The Electric Telegraph Company and Charles Massi, from making, altering, using, or selling the battery registered

by Massi as the "Percolating Galvanic Trough," the same being identical in principle with the invention of the plaintiffs.* The Electric Telegraph Company had, it appeared, been so well satisfied of the advantages of such a battery, that, on the 25th of January, (sixteen days before the date of plaintiffs' patent,) they entered into an agreement with Massi, whereby, in consideration of a battery then deposited by Massi with them, they agreed to pay him 5*l.*, they being at liberty to make trial of the same for 30 days after the date of the agreement; and if they determined to adopt it, the company were to pay, for the space of ten years, if they should continue to use the battery, 20*l.* for the first year, besides the 5*l.* already paid, and 25*l.* for each succeeding year during the term, &c. But in case, at the expiration of the thirty days, the Company should decline to adopt the invention, they bound themselves to keep the same secret from all persons whomsoever.

Fig. 2.

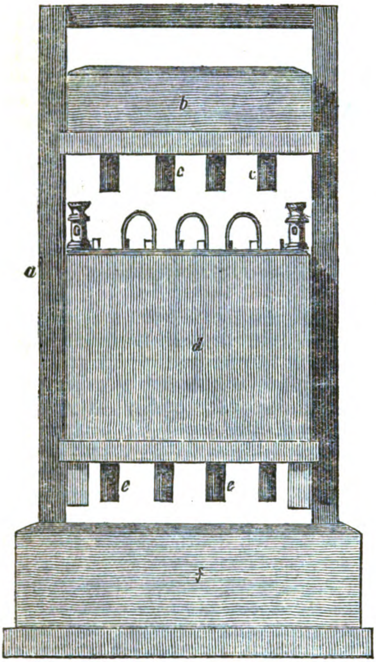
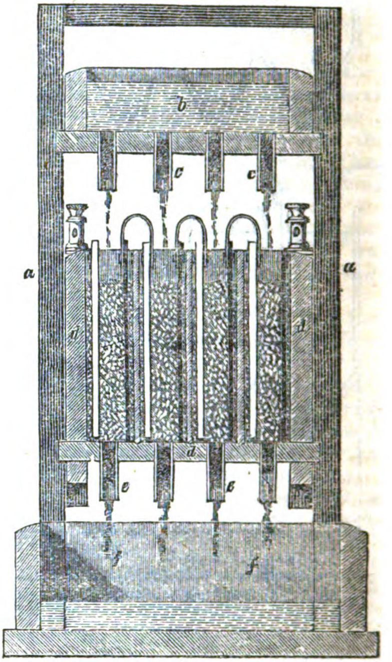


Fig. 3.



Mr. Bethell and Mr. Heathfield appeared for the Electric Telegraph Company, but did not enter at any length into the case, as they were prepared to abide by the decision of the Court as against Massi.

Mr. Rolt with Mr. Medcalf, appeared

* Mr. Massi's own description of his apparatus is as follows:—"It consists in a peculiar form of Galvanic Trough, by the employment of which a comparatively small quantity of exciting liquor is required for sustaining the power of the battery, and much less attention is required in replenishing the cells than is at present necessary. The novelty of the design consists in making an opening in or near the bottom of the trough, one opening for every cell, in order that the exciting liquor, in percolating through the sand, charcoal, or other absorbent substance with which the trough is filled, may find an exit, and fall into a receiver below. *a a* is a frame, which, at its upper part, supports a vessel *b*, for containing the exciting liquor supplied through tubes *c c* to the several cells in the trough *d d*, also supported by the frame *a*. Each cell is provided with a tube *e*, in which sponge or other suitable substance is placed, to prevent the too ready discharge of the liquor into the receiver *f f*, below; and the tubes *c* are also furnished with sponge, to check the flow of the liquor into the battery. After the sand is saturated with the exciting liquor, every additional drop of liquor which falls into the cells will discharge a corresponding drop into the receiver *f*, and thus a continuous change of the liquor is effected; whereby, in practice, I have found that the metal plates will sustain the corroding action of the liquor a much longer time than when suspended in stagnant liquor."

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on behalf of CHARLES MASSI, and contended that this was evidently a case of rival inventors; it was one where the same idea had suggested itself to two parties almost simultaneously. There was no imputation that his client had stolen the idea from the plaintiffs (Mr. Stewart said "certainly not"); that the REGISTRATION, he knew, was overridden by the PATENT of the plaintiffs, but he thought that they were in a position to prove a public use, by his client having sold one of the batteries to the ELECTRIC TELEGRAPH COMPANY in January.

HIS HONOUR THE VICE CHANCELLOR, in giving judgment, said, the case appeared to him to be perfectly clear with respect to the *public use*. The ELECTRIC TELEGRAPH COMPANY having agreed not to *divulge* the secret to any one, in case of their not electing to adopt it, the disclosure to them could not be construed into a *public use*. It appeared quite clear that the plaintiffs were the first inventors. It was almost a similar case to two great astronomers discovering a new comet at about one and the same time, though, of course, he who was first in time, must be regarded as the actual discoverer. The only difference was—this was a nearly cotemporaneous discovery in ELECTRICITY. He should grant the injunction, as prayed.

EXTENSION OF PATENT.

Privy Council.—May 15, 1847.

In Re Alexander Mitchell.

In 1833, Mr. Mitchell obtained Letters Patent for his well-known screw piles on which the lighthouses on the Maplin Sand and other places have been erected. He now petitioned for an extension of his patent on the ground that he has not been hitherto sufficiently remunerated for the ingenuity, time, and trouble he has expended on the invention, and that it was one of such public utility as to be deserving of further protection.

Mr. Mitchell, and his son, Mr. John Mitchell, and Mr. Jackson, gave evidence as to the money expended and received on account of the patent.

Mr. James Walker, C.E., stated, that the Trinity-house, at his recommendation, had erected the lighthouse on the Maplin Sand; and he had been perfectly satisfied with it. A beacon was also erecting upon Mr. Mitchell's screw piles on the Tongue Sand. It was the most economical and effectual mode of forming a foundation on banks covered by the sea that had yet been discovered; and there were other spots imperfectly lighted to which it might be applied with advantage.

Mr. S. P. Bidder said, he was resident engineer of the Fleetwood-on-Wyre Railway, and had charge of the lighthouse erected by the Messrs. Mitchell, in Morecombe Bay, in the year 1840, since which time it had required no alteration or repair, giving general satisfaction. It was the best light on the coast. There was generally a very heavy sea on that part of the coast, but the piles were so placed that the waves went through them, and so little vibration was produced, that it did not affect the clock in the tower.

LORD BROUGHAM, in giving judgment, said, that from the peculiar nature and merit of the invention, and considering that it was one which would not be expected to come into general use for some years, their lordships had come to the decision of recommending to her Majesty to extend the patent for the full term prayed for, namely—fourteen years.

AMERICAN PATENT CASE.—EXTENT OF USER NECESSARY TO UPHOLD PATENT RIGHT.

Circuit Court of the United States, New York.—In Equity.

April 21.

George N. Benjamin, jun., and Henry B. Tatham, vs., R. W. Lowber, Thomas Otis Leroy, and David Smith.

Before Judges Nelson and Betts.

The motion for an injunction against the defendants in this case to restrain them from infringement of a patent for lead-pipe machinery, came up for argument on the 14th April inst.

The plaintiffs claimed as American patentees under an assignment from C. and J. Hanson, the alien inventors.

The patent was resisted upon several grounds.—Among them were

1st. Want of novelty of invention. The defendants cited the machines of T. Burr, J. Wayne, B. Titus, G. W. Potter, Jesse Fox, and several others.

2d. That the 15th Sect. of the Act of 1836, provides for a forfeiture of a patent if it can be proved "that the patentee of an alien, at the time the patent was granted, had failed or neglected for the space of eighteen months to put and continue on sale to the public, on reasonable terms, the invention or discovery for which the patent issued." It was contended that this provision applied to the American assignees and patentees, and that in fact a forfeiture had occurred by such failure and neglect.

3d. It was urged that a patent for this invention was originally issued in England:

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that it was first obtained in the United States in 1841, with a specification differing from the English patent; and that it had been surrendered and re-issued in 1846 with a new claim differing from both.

4th. That the defendants, Leroy and Smith, were not the owners of the machine, but merely supplied a material and sold the product.

There were other points of minor importance, and all of them were denied by the plaintiffs. The argument occupied the Court four days. For the plaintiffs George C. Goddard, Charles O'Conor, and S. P. Staples, Esqs. For the defendants William Curtis Noyes, and Daniel Lord, jun. Esqs.

The decision of the Court was given as follows:—

"We are satisfied—

"1st. The specification of the patent to plaintiffs (re-issued 16th March, 1846), claims as the invention a combination or arrangement of the parts of machinery described; by which pipe, with the operation of hydraulic pressure, is made with lead in a *set* or semi-fluid state.

"2nd. That the machine used by the defendants is in substance the same as plaintiff's.

"3rd. The patentees can legally take out the re-issued patent for more than is described in the surrendered one, if it does not exceed the actual discovery when the first was taken out.

"4th. The evidence satisfactorily establishes that the Hansons were the first and original discoverers of the combination or arrangement embraced in the patent.

"5th. The patentees, after the assignment of the right and the grant of the patent to them, took and held it, with all the privileges of an American patent, and the alien clause in the 15th sect. of the Act of 1836 applies only to alien patentees, and not to American assignees.

"6th. But even if the assignee takes the right with the limitation or condition of the alien, still the plaintiffs have satisfied the act. They need not prove that they hawked the article about for a market, and that they tried to sell it to any person. Those seeking to defeat thepatent must prove the plaintiffs neglected or refused to sell for reasonable prices when application was made to them.

"7th. The sales by the plaintiffs, and those they proposed, and offered, were of the invention or discovery within the meaning of the act.

"8th. The proof is sufficient to charge all the defendants, directly and indirectly, with using the machinery, and violation of the plaintiffs' rights.

"Let an injunction therefore issue."—*New York Courier and Inquirer.*

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 505.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

John Shankster, of Great Pulteney-street, Westminster, oval turner: of a new invented method of making or building wheeled carriages for coaches, chariots, phaetons, calashes, gigs, chaises, wagons, carts, drays, field-pieces; and others, with boxes and axle-trees, on an entire new principle, whereby the greatest part of the friction attending boxes and axle-trees heretofore made is taken off; and such new invented carriages are rendered far more light and easy for work and draught than any heretofore made; and which said boxes are also applicable in hydraulic, steam, and other engines, mills, and machinery where spindles, axle-trees, cranks, or arbors are used, which do not work on centre-points. Cl. R., 26 Geo. 3, p. 14, No. 8. Dec. 9, last; Jan. 5, 26 Geo. 3, 1786.

Joseph Lucas, of Long Acre, tin-plate worker: of a new or improved mirror-lantern, or lamp, for staircases, carriages, chaises, &c. Cl. R., 26 Geo. 3, p. 14, No. 6. Dec. 21, 26 Geo. 3; Jan. 20, 26 Geo. 3, 1786.

Walter Gordon, of Beaufort-buildings, Middlesex, gent.: of a new kind of purified soap, which is infinitely superior to any hitherto used for washing, shaving, and other purposes (called Cream of Violets, and Violet-Soap). Cl. R., 26 Geo. 3, p. 14, No. 1. Jan. 23, 26 Geo. 3; Feb. 22, 1786.

James Bell, of Battersea, malt-distiller: of an invention of making, from the refuse of malt-wash, after distillation, commonly called spent-wash, a vegetable acid or vinegar, for the purposes of trades and manufactures. Cl. R., 26 Geo. 3, p. 15, No. 4. Jan. 31, 26 Geo. 3; Feb. 29, 1786, 26 Geo. 3.

Robert Cameron, of Green Dragon wharf, Lambeth, engineer: of certain new invented methods of raising coals, ores, and water (from mines), by certain pieces of mechanism. Cl. R., 26 Geo. 3, p. 15, No. 3. Jan. 28, 26 Geo. 3; Feb. 24, 1786.

Jacob Bunnett, of Whitechapel, Middlesex, stationer: of a machine for printing of paper-hangings, calicoes, cottons, and linens in general, whereby any number of colours may be printed thereon at one and the same time, and whereby ten times as many pieces

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may be printed in as short a space of time as one piece is now printed by the common method. Cl. R., 26 Geo. 3, p. 15, No. 1. March 18, 26 Geo. 3; April 15, 1786.

Charles Frederick Hempel, melting-pot manufacturer, of Cheyne-row, Chelsea: of an invention of fire-proof earthern cases of different shapes, with heaters made of the same composition, for the warming of beds, dishes, plates, &c.; likewise for warming and keeping comfortable the feet in carriages, pews of churches, &c. Cl. R., 26 Geo. 3, p. 16, No. 18. Feb. 7, 26 Geo. 3; March 6, 1786.

Adam Walker, Hanover-square, gent.: of an empyreal air-stove, for the purpose of purifying the air of churches, theatres, jails, sick, and all other rooms, and inclosed buildings. Cl. R., 26 Geo. 3; p. 16, No. 17. Feb. 21, last; March 17, 1786.

Francis Day, of Tavistock-street, Covent-garden, hair-merchant: of an invention of lengthening human and other hair for the purpose of making trails, braids, and curls to cover and adorn the human head, and of new mounting the same. Cl. R., 26 Geo. 3, p. 16, No. 11. Feb. 27, 26 Geo. 3; March 25, 1786.

Richard Ireland Thurgood, of Lombard-street, London, cutler: of certain considerable improvements in the construction of spurs, whereby they are freed from the inconveniences generally complained of. Cl. R., 26 Geo. 3, p. 16, No. 8. March 11, 26 Geo. 3; April 1, 1786.

Lancelot Palmer, of Little Britain, Aldersgate, brazier: of a tea and coffee-urn upon a new principle. Cl. R., 26 Geo. 3, p. 17, No. 8. May 3, 26 Geo. 3; June 3, 1786.

Samuel Miller, of Westminster, engraver: of a machine upon an entire new principle, for the purpose of ascertaining the weight of all kinds of goods, wares, merchandize, and other substances, with much greater precision, and infinitely more expeditious, than by any method hitherto practised. Cl. R., 26 Geo. 3, p. 17, No. 7. May 13, 26 Geo. 3; June 12, 1786.

John Page, of Gough-square, Fleet-street, jeweller: of a new machine for extricating persons from buildings on fire; also for the more certain and speedy extinguishing of fires, and for facilitating the erection and repairs of buildings, and for other purposes. Cl. R., 26 Geo. 3, p. 18, No. 4. June 22, 26 Geo. 3; July 22, 1786.

Francis Moore, of Cheapside, linen-draper: of a coach with two wheels, on a new construction and new springs, which, by being fixed in a new method, with the addition of new braces, will sustain or carry such coach, or any other coach, chariot, &c., mounted upon two wheels, with greater ease and safety, and may be drawn with fewer horses than usual. Cl. R., 26 Geo. 3, p. 18, No. 3. June 13, 26 Geo. 3; July 13, 26 Geo. 3, 1786.

Francis Moore, of Cheapside, linen-draper: of a new quadrant, or quarter circle and standard, which, by being affixed to doors, will, by the help of a line, pulleys, and weights, shut the same with more ease and certainty, and with less noise than has been done by any method hitherto made use of. Cl. R., 26 Geo. 3, p. 18, No. 2. June 13, 26 Geo. 3: July 13, 26 Geo. 3, 1786.

William Tickell, of Walcot, Bath, apothecary: of a new chemical medicine, called (by the specifier) "Spiritus Æthereus Anodynus, or Anodyne Æthereal Spirit." Cl. R., 26 Geo. 3, p. 18, No 1. Aug. 5, 26 Geo. 3; Aug. 21, 1786.

William Dudley, of Westminster, white-smith: of a buckle, chape, or fastening for men and womens' shoes, with a new constructed spring jointed plate, on which may be fixed any kind of rim, ornament, or device. Cl. R., 26 Geo. 3, p. 19, No. 15. Aug. 5, 26 Geo. 3; Sep. 1, 1786.

William Kerr, of the King's Mews, Charing-cross, bit-maker: of a new method of intermixing and infusing certain metallic substances into the body and pores of all sorts of iron and steel, and other metals, which prevents the pernicious effects of air and moisture. Cl. R., 26 Geo. 3, p. 19, No. 14. Aug. 3, 26 Geo. 3; Aug. 26, 1786.

John Skidmore, of Coppice-row, Clerkenwell, stove grate-maker: of a new method of ornamenting all manner of stove-grates, stove-fronts, fenders, shovels, tongs, pokers, chimney-pieces, chimney-panels, the inside of houses and ships, all sorts of japan wares, all kinds of cabinets and furniture, the outside of coaches and other carriages, and all sorts of china and earthen wares, with foil stones, Bristol stones, paste, and all sorts of pinched glass, lapped glass, and every other stone, glass, and composition used in or applicable to the jewellery trade. Cl. R., 26 Geo. 3, p. 19, No. 12. Aug. 5, last; Sep. 4, 26 Geo. 3, 1786.

John Reeder, of Jamaica: of new invented coppers and vessels [for clarifying cane juice and granulating sugar]. Cl. R., 26 Geo. 3, p. 19, No. 3, Oct. 6, 26 Geo. 3; Oct. 25, 26 Geo. 3, 1786.

Robert Meares, of Frome (Somerset), dyer: of a new-invented swivel and socket for the perches of four-wheeled carriages, which prevents their being overturned, and makes them run easy. Cl. R., 26 Geo. 3, p. 19, No. 2. Oct. 10, 1786, 26 Geo. 3; Oct. 30, 27 Geo. 3, 1786.

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John Beale, of the City-road (Middlesex), umbrella maker: of an umbrella with joints, flat springs and stops, worm springs and bolts, slip bolts, screws, slip rivet and cross stop, and square slips. Cl. R., 26 Geo. 3, p. 19, No. 1. Oct. 6, 1786; Nov. 3, 1786.

Thomas Smith, of Farnham (Surrey), saddler: of a new method or methods of applying springs to saddles, stirrups, irons, martingal, rings, whips, hunting-caps, belt buckles, bridle-bits, turrets for coach, phaeton, or other kind of harness, squares for stable collar reins, trusses or bandages for ruptures, and milking pails. Cl. R., 26 Geo. 3, p. 20, No. 15. Sept. 29, 26 Geo. 3; Oct. 21, 1786.

John Geib, of Tottenham Court-road (Middlesex), musical instrument maker: of an entire new improvement upon the musical instruments called the pianoforte and harpsichord, by which the same will become perfect and complete instruments of their kind, and by which the same can be more easily tuned and played upon, and which improvement extends to each of such instruments equally alike. Cl. R., 26 Geo. 3, p. 20, No. 1. Nov. 9 last; Dec. 7, 1786.

(*To be continued.*)

LIST OF ENGLISH PATENTS GRANTED FROM MAY 22 TO MAY 27, 1847.

William Bridges Adams, of Old Ford, Middlesex, engineer and carriage builder, and Robert Richardson, late of Manningtree, Essex, but now of Hadleigh, Suffolk, civil engineer, for certain improvements in the construction of railways, and of engines and carriages used thereon; and also in transport and storage arrangements for the conveyance, management, and preservation of perishable articles. May 22; six months.

Charles Chinnock, of Regent's Quadrant, gentleman, for improvements in regulating motion and controlling friction in the joints and other parts of furniture, machinery, and carriages. May 22; six months.

Henry John Nicholl, of 114, Regent-street, tailor, for improvements in garments, and in pocket-bags, and other receptacles. May 22; six months.

William Edward Newton, of Chancery-lane, civil engineer, for a new or improved instrument or apparatus for making or manufacturing capsules for enclosing medicinal preparations, or other liquid or solid substances. May 22; six months.

William Dyne, of Rochester-terrace, Stoke Newington, corn merchant, and Morys Haggar, of Church-street, Stoke Newington, gentleman, for certain improved apparatus for protecting life and property in cases of shipwreck. May 22; six months.

Jean Marie Fourmentin, of New Bridge-street, Blackfriars, gentleman, for improvements in the manufacture of carbonate of lead. May 22; six months.

Sydney Smith, of Nottingham, engineer, for a certain improved apparatus for determining the pressure of steam in boilers, and regulating the dampers in a furnace. May 22; six months.

Moses Poole, of London, gentleman, for improvements in the construction of pneumatic springs and presses. (Being a communication.) May 22; six months.

John Aitken, of Russell-street, Bermondsey, leather-dresser, for improvements in steam-engines, or atmospheric engines, in distilling and in pumping water. May 22; six months.

Henry Le Lievre, of Cleveland-street, Mile-end, silk-dyer, for improvements in dyeing and stretching silk and in finishing plush. May 24; six months.

Pierre Armand Leëonte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in the machinery for cutting wood, and in laying and uniting veneers. (Being a communication.) May 25; six months.

Reginald James Blewitt, of Llantarman Abbey, Newport, Esq., for improvements in the manufacture of malleable iron. May 27; six months.

Henry M'Evoy, of Hall-street Works, Birmingham, machinist, for improvements in the manufacture of, and in the packing of hooks and eyes. May 27; six months.

George Benjamin Thorneycroft, of Wolverhampton, iron-master, for improvements in the manufacture of rails for railroads. May 27; six months.

James Johnstone, of Willow Park, Greenock, Esq., for certain improvements in the manufacture of sugar. May 27; six months.

Alexander Allan, of Crewe, in the county of Chester, engineer, for certain improvements in turn tables to be employed on or in connection with railways, part or parts of which said improvements are also applicable to the construction of tubular boilers. May 27; six months.

Henry Gilbert, of Marina St. Leonards, surgeon, for improvements in apparatus for holding sacks to facilitate the filling them with corn or other materials. May 27; six months.

Christian Schiele, late of Frankfort-on-the-Maine, but now of Manchester, mechanician, for certain improvements in machinery, or apparatus, for condensing steam, which said improvements are also applicable to other similar purposes. May 27; six months.

MONTHLY LIST OF PATENTS GRANTED FOR SCOTLAND FROM THE 16TH OF APRIL TO THE 22ND OF MAY, 1847.

John Coates, of Seedly, Lancaster, calico printer, for certain improvements in machinery or apparatus for cleaning the surface of woven fabrics, or freeing the same from fibrous or other loose matters, previous to printing thereon. April 29.

Joseph Woods, of Bucklersbury, London, engineer, for certain improvements in springs for supporting and resisting sudden and continuous pressure. (Being a communication from abroad.) April 30.

Louis Sylvain Gonin, manufacturer, of Paris, in the kingdom of France, for improvements in printing stuffs, paper, and other matters. May 4.

Philip Barnard Ayres, of No. 12, Howland-street, Fitzroy-square, Middlesex, Doctor of Medicine, for certain plans and improvements in preparing putrescent organic matters, such as night-soil, the matter in suspension in the water of sewers, and other similar matters, for the purpose of manure, or for other purposes, and for apparatus for the same. May 4.

George Copland, of 37, Frederick-street, Edinburgh, for an instrument or apparatus for measuring the human body, for the purpose of fitting garments with ease and accuracy without reference to the proportions of the breast and shoulder measures, and which invention he names the *corporimensor*. May 5.

Thomas Waterhouse, of Edgeley, in the Borough of Stockport, Chester, cotton manufacturer, for certain mechanical improvements applicable to railway engines and tenders, and to railway carriages of various kinds. May 8.

Maximilian François Joseph Delfosse, of Regent street, Middlesex, Esquire, for improvements in preventing and removing incrustation in steam-boilers. May 13.

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Conrad Haverkam Greenhow, of North Shields, gentleman, for improvements in the construction of ships or vessels, and in propelling ships and vessels. May 14.

Samuel Hardacre, of Manchester, Lancaster, machinist, for certain improvements in machinery or apparatus for opening and for carding cotton and other fibrous substances, and for grinding the cards of carding machines. May 17.

George Benjamin Thorneycroft, of Wolverhampton, Stafford, ironmaster, for improvements in the manufacture of rails for railways. May 18.

Gardner Stow, of King-street, Cheapside, London, gentleman, for improvements in the construction of steam vessels, and in apparatus for propelling ships and other vessels. (Being a communication from abroad.) May 18.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
May 20	1074	James Chesterman, machinist, and John Grattan, cabinet-case maker	Both of Sheffield	Portable travelling-case.
21	1075	E. L. Simmons	Coleman-street	Improved portable hygrometer.
,,	1076	George Inman, joiner	121, High-street, Poplar	Improved compass-plane.

Advertisements.

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Achromatic Microscopes.
The Megaloscope (a new Optical Instrument).

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The Patent Law of France,

with an Appendix containing full Information as to Patents generally on the Continent, the mode of applying for them, the Laws respecting them, and the Total Cost to the Patentee. By G. Merle, agent for Foreign Patents, 18, Rue Vivienne, Paris. To be had, price One Shilling, post free 4d. extra, of W. Strange, 21, Paternoster-row, and all Booksellers.

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London, May 17, 1847.

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The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

CONTENTS OF THIS NUMBER.

NOTICES TO CORRESPONDENTS.

Inquirer.—*It is no defence to an action for infringement that the defendant has only manufactured the patent article for his own use; stolen goods are not the less stolen that the thief himself chooses to consume them.*

Articles intended for early insertion: Mr. De la Haye on Submarine Railways — Mr. Pitter on Aerostation — Rev. Mr. Kirkman on certain "Diary" Questions and Solutions—T. T. on the Translator of "Poisson's Demonstration of the Parallelogram of Forces."

Alban's "High Pressure Steam Engine investigated." Not overlooked; it shall have due attention.

B. T. M.—Charcoal is *subject to spontaneous combustion, but chiefly when in a powdered state.*

Sulphate of Quinine,—Pelletier and Desprez's patent will expire 25th Aug. next.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,

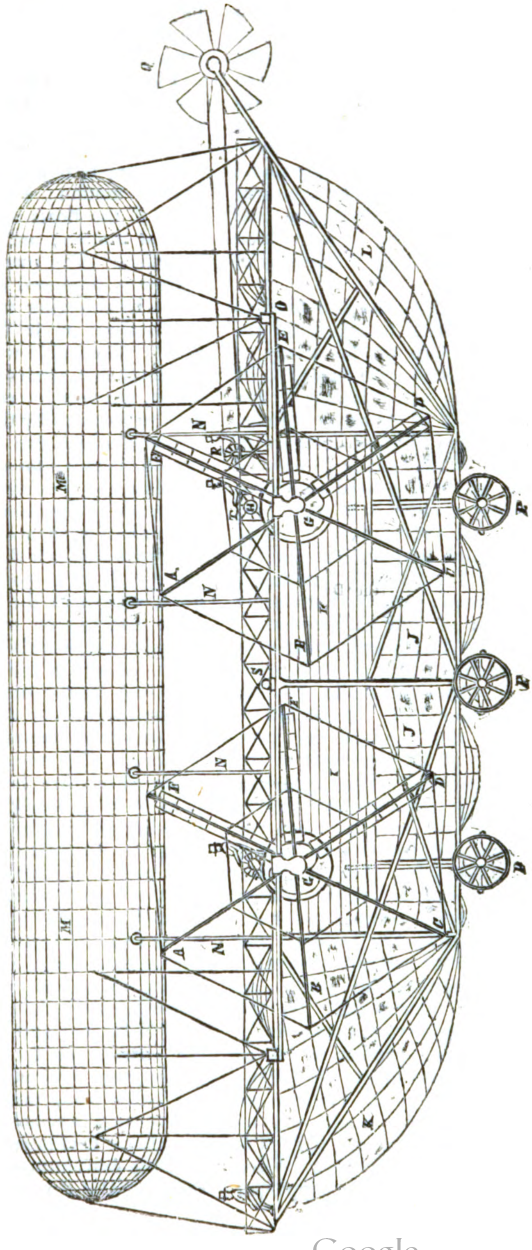
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1243.] SATURDAY, JUNE 5. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.

ARCHIMEDEAN BALLOON.

Fig. 1.



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ARCHIMEDEAN BALLOON.

Sir,—The idea of aerial navigation is of so fascinating a nature, that I think the attractions of the subject may be pleaded as an excuse for my troubling you with a plan, which the practical man of science may perhaps consider as crude and unsatisfactory, while yet I would hope that my scheme, even if it prove a failure, may do something towards bringing within our reach the means of traversing the regions of air, and ploughing that viewless ocean which flows round our globe, with something like the same facility that the mariner ploughs that pathless and treacherous ocean, which has hitherto been the only "highway of nations."

The balloon has for some time afforded a means of ascending to the aerial regions, but it remains at the mercy of every wind that blows, with regard to its horizontal motion; and it is only by the precarious method of rising or falling, so as to encounter different currents of air, that it can be brought to go onward in anything like the desired direction. This incapacity renders it a mere toy, after all the high expectations it raised when it first came into notice. In the following plan I propose to procure a motion at any angle with the horizon by the revolutions of four paddle-wheels, which have their float-boards broadways during any required half of their revolution, and edgeways while passing through the other half. A motion to any point of the compass is procured by means of an apparatus at the stern of the machine. This apparatus is similar to the Archimedean screw, and being made to revolve when required in a vertical plane on an axis at right angles to the course of the machine, it brings the stern of the machine round to the right or left, according to the direction in which the screw revolves, and thus the head of the machine is pointed in the right direction; the paddles all the while doing their work. As the weight of the machine would most likely be too great for the paddles to lift of themselves, large bags of gas are fastened under the machine to increase its buoyancy, and as this might not be enough, a long cylindrical gas balloon is secured a few feet above the deck. When onland, the whole machine is supported on six wheels, with strong, but elastic springs, which serve to diminish the force of the shock when the machine descends to the earth; and if the descent be made at a very small angle with the horizon, the shock may be made almost imperceptible.

Fig. 1 is a full length view of my proposed machine, in which it will be observed, that the sweeps of the paddle-wheels in passing from A to C have their floats very nearly at right angles to their line of motion; while in passing from D to F the floats are edgeways to the line of motion; and of course produce no effect. The manner in which this motion is produced will be best understood by referring to fig. 3, where the guide-wheel G is drawn on a larger scale. The guide-wheel is hung upon the shaft that carries round the paddle-wheel, but does not revolve with it, being kept in its place by the cog-wheel H, by means of which the guide-wheel can be turned round into any position, so that the float boards of the paddle-wheel may be brought broadways during any required half of their course, and of course edgeways through the other half. This cog-wheel H is worked by a man on deck, who turns the wheel T, as may be more clearly seen by fig. 2. Each two opposite cog-wheels are worked by one shaft, on which the wheel T is fixed; therefore if the opposite guide-wheels are similarly hung at first, the opposite paddle-wheels always correspond in their motions. The manner in which these guide-wheels are locked and unlocked, so as to keep firmly in their places and yet admit of being easily moved, is shown in fig. 4. One man is required to work each pair of cog-wheels. I I is the room for the engines, &c. J J is a gas-bag secured under the engine-room. K and L are two other gas-bags, secured at the two extremities of the machine. M M is the cylindrical gas-balloon secured above the deck, being fastened to posts N N N N, and still further fastened at the extremities by ropes. The lower gas-bags are secured by ropes and braces, the latter being made of wood or iron, and serving to uphold and strengthen the machine. O O is an outer beam to support the extremities of the paddle-wheel shafts. P P P are the wheels for sup-

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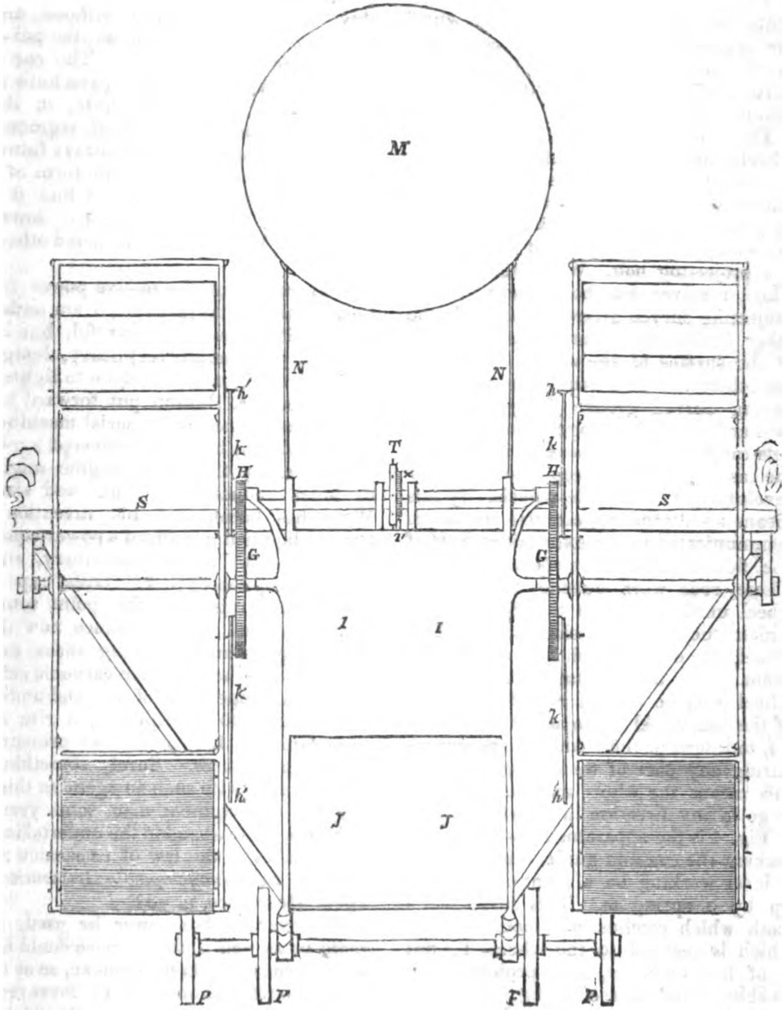
porting the machine when on land. Braces connect the sweeps with each other in order to strengthen the paddle-wheels; perhaps it would be well to make these braces of rigid cordage, such as might be procured from the cocoa-nut

Fig. 2.



fibre. Q is the screw for steering the machine, and is worked by a band proceeding from a wheel R on deck, which wheel is to be worked by one of the crew. Should manual strength prove insufficient for this, the wheel might be connected

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with the engines, but it must be so done as to be perfectly under control. But as manual strength would probably be sufficient, I have not planned any machinery for working the screw by help of the engines. S is the mouth of the chimney.

Fig. 2 is a section of the machine. Only two sweeps of each paddle-wheel are represented, to prevent confusion. As the same letters are put to the same parts in all the figures, further explanation is not required here.

Fig. 3 is a view of one of the guide-wheels, showing the manner in which it acts on the sweeps of the paddle-wheel. The beams or levers marked *h h*, work on pivots between the guide-wheel and the sweeps. At each end of every beam is a projecting bolt. While the paddle-wheel revolves one bolt works in the projecting curved groove *i i i*, while the other is disengaged, and just runs clear of the surface of the wheel. Presently the other bolt gets caught in the projecting curved groove *j j j*, and the former bolt is disengaged, until it again gets caught in the groove *i i i*. This is the case with every sweep through every revolution of the paddle-wheels. By this means an alternating circular motion is communicated to the extremities *h' h'* of the float-boards by metallic rods *k k*. These rods work outside the paddle-wheel until they join the floats, after which they work inside the paddle-wheel, one end of each float acting as a beam. As before stated, the guide-wheel may be shifted round by means of the cog-wheel H, so as for the curves *i j*, to intercept the beams on the sweeps during any part of their progress. By this means the whole machine is made to go in any direction in a vertical plane.

Fig. 4 is the apparatus for working and locking the cog and guide-wheels: *u* is a lever working on a pivot *v*, and kept up by a spring *w*. This lever has a tooth which catches in a toothed wheel which is secured to the wheel T, but is of less diameter, and projects from its side, as may be seen in fig. 2. When the guide-wheels are to be shifted, the person who is to do it, lays hold of the wheel T and presses his foot on *u*; this brings the lever into the position indicated by the dotted lines, and the wheel T may then be turned. When the guide-wheels are brought into the required position, the man working at T withdraws his foot from the lever; which then rises up and locks the toothed wheel. The wheel T may then be left to itself.

In fig. 5 I have given the form of a parachute, which, in my Lilliputian experiments, has always answered remarkably well. It descends without any oscillations; if the wind blows, the parachute simply goes with it. The car is hung pendant as near the parachute as possible. A model parachute, in the form of a cone or spherical segment, concave downwards, I have always found to oscillate greatly; and in the form of a parachute here represented, I find it a bad plan to hang the car far down, although it is generally considered otherwise.

With regard to the motive power for working the aerial machine, I am undecided. Steam is very powerful, but its machinery is generally very heavy, though probably much might be done to lighten it. When Mr. Henson put forward his plan for constructing an aerial machine, it was said that he had discovered a method whereby the steam-engine might be much reduced in weight and size. What has become of his invention? Cannot liquified gas afford a power equal to steam, with lighter machinery, and less consumption of fuel? Great expectations were raised on this point some years ago, and cannot science now do something towards fulfilling those expectations? When liquified carbonic acid gas is at a temperature of 50°, and under a pressure of 30 atmospheres, a rise in temperature of 180° produces a pressure of 90 atmospheres. Surely something could be done with such an agent as this, although one eminent man, some years back, was led to abandon the undertaking by anomalies in the law of expansion in this gas. See *Encyclopædia Britannica*, article Mechanics, p. 437.

Whatever motive power be used, it would be as well if the furnace could be made to consume its own smoke, so as to dispense with a chimney. If, however, a chimney be necessary, care should be taken that no sparks issue from it to fire the gas bags. Perhaps, if possible, it would be well to let a little steam escape with the smoke, so as to extinguish the sparks. If the gas-bags could be made proof against the sparks, without becom-

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ing too heavy, there would then be no danger to apprehend from the chimney. If the machine, as I have planned it, should be considered too heavy, its capability of rising may be increased in many ways. The paddle-wheels may be widen-

Fig. 3.

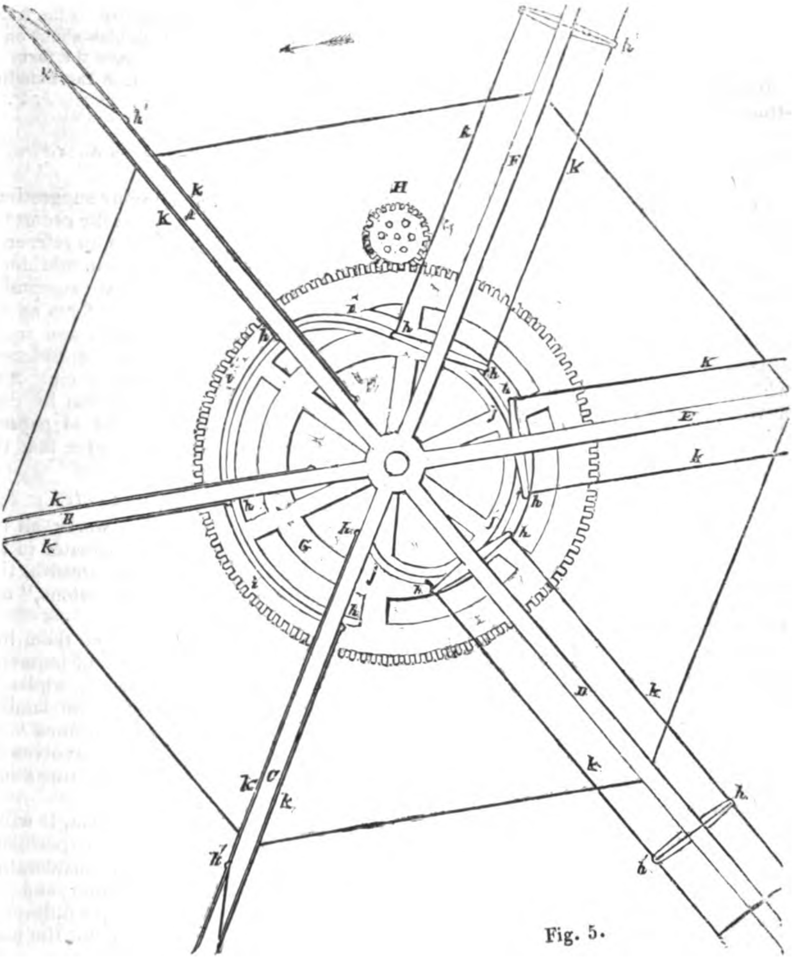


Fig. 4.

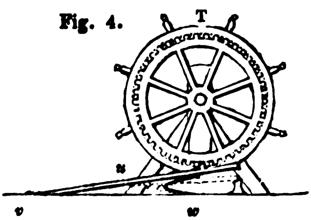
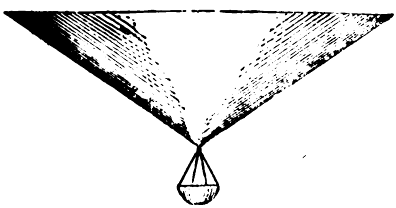


Fig. 5.



ed, the number of floats in each sweep increased, as well as the number of sweeps, and the cylinder of gas may be enlarged. This last is an unfailing source

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of buoyancy, but if the cylinder be made very large, the machine will become unmanageable.

I am, Sir, yours &c.,
JOSEPH PITTER.

7, George-street, Hastings, April 22, 1847.

P.S.—Since writing the preceding, it has struck me that rigid cords, or small chains, might be advantageously substituted for the connecting rods which I have planned for working the levers connected with the floatboards of the paddle-wheels. The form of my parachute was chiefly suggested by the fragments of thistle-down which blow about on a summer's day, and which have the form of an inverted cone, with a little car hanging pendent close to the vertex. J. P.

GEOMETRY OF THE LINE AND PLANE.—BY T. S. DAVIES, F.R.S., L. & E., F.S.A., ROYAL MILITARY ACADEMY, WOOLWICH.

[In the *Miscellanea Mathematica* (No. xiv., vol. xliv., p. 484,) some suggestions were offered concerning the imperfect conceptions of Euclid as respects the geometry of the line and plane; and especially on the incompleteness of his details, in reference to the wants of the architect and engineer of our own day. After much consideration, the Editor has been led to believe that he would render an acceptable service to a great number of his readers, by giving, in as concise a form as the subject permits, a series of propositions respecting *the line and plane;* and more especially if they were arranged in that natural order of consecutive dependence, which is so essential to both the understanding and the remembrance of them. And having communicated his views to Professor Davies, he is glad to say that he cordially concurs in them, and has engaged to carry them out in a series of papers, of which the first is now published. The mathematical world will agree that the subject could not be in better hands.—ED. M.M.]

CHAP. I.—*Preliminary discussions, definitions, axioms, and notes.*

In the geometry of the first six books of Euclid, and in analogous works, all the points, lines, circles, &c., which are concerned in any proposition, are situated in the same plane. From the plane having only two dimensions, length and breadth, this department of geometry has been called "the geometry of two dimensions," and frequently, "plane geometry."

When we consider points, lines, or other figures, as being some of them in a plane, and others above or below that plane, we enter upon a new class of inquiries, in many respects dissimilar to those which occurred in plane geometry; whilst, in other respects they bear a considerable analogy to our earlier and more familiar modes of investigation. This branch of science has been appropriately termed "the geometry of three dimensions," or otherwise "solid geometry;" as it involves the ideas of length, breadth, and depth, or of the three dimensions which constitute a solid in ideal space.

Since we extend our idea of space to include an additional dimension, it will at once occur to us that we must extend, correspondingly, our axioms and postulates to adapt them to the new circumstances which are introduced into consideration. These extensions or additions will, however, be more limited in number and less recondite in character, than may at first sight be supposed. The principal difference, and chief difficulty will be found in the failure of the diagram to represent the magnitudes with that approximate truthfulness to which we have been accustomed in plane geometry. As diagrams, they become in solid geometry only the visual pictures or perspectives of the objects designated by them; and whether the figure be projected on the plane by means of lines parallel to each other through all the points of its surface, or by lines radiating from a single point, the true proportions of lines, the true positions of points, the true form of a curve, or the true magnitude of an angle, either of which lies out of the plane of the diagram, are changed into others, the relations of which to the originals are not readily perceived.

When the representation is made by lines drawn through the same point, and every point of the object, to meet the plane of the diagram, we form the ordinary *perspective representation* of it, used by the painter. This, however, is always found to create greater difficulty in following the course and tracing the relations of the parts of the figure, than when the representation is made by lines all parallel to each other through the points of the figure. This method of representation is called *parallel projection*, or, more conveniently, *parajection.* It so far simplifies the

representation as to represent parallel liness by parallel lines; and if these lines be of equal length in the original or true figure, their representations will be equal. Equal angles, too, if their containing lines be parallel will be represented by equal angles; and some few other advantages which will be hereafter seen, also accrue from this method. On the other hand, equal lines, which are not parallel, are not represented by equal lines; nor are equal angles whose containing sides are not parallel, by equal angles; and the angles themselves are but rarely represented by angles equal to them. In short, points above the plane being represented by points on the plane, the imagination is perpetually taxed to conceive them to be where they are not in the diagram; and it is to the twofold operation of imagining things to be different from what they are, and simultaneously reasoning upon them as they hypothetically exist, that the great difficulty, which has been imagined to exist in this study, is mainly due.

The difficulty thus created is an artificial, and at the same time an unnecessary one. In plane geometry we represent the subjects of our consideration with a degree of approximation to their hypothetical truth, which leaves no room for the imagination to correct the general impression made upon the sight. We have the same power to remove this artificial difficulty from solid geometry, by the use of *models* which represent the real circumstances of the proposition, whether it be a theorem or a problem. Such models are so easily formed by means of card-board and thread that there can be no apology made for refusing to use them, on the score of the time employed in their formation; and, indeed, when the student has once seen the readiness and perspicuity with which his reasonings may be carried on by means of them, he will never fail to have recourse to them when the objects of his contemplation do not range themselves clearly before his mind, from the suggestions of the diagram itself. There is, indeed, a class of absurd purists in geometry who object to the use of models on the ground of its being "an unscientific method;" but, as this is not the place to discuss the question with *them,*—they are referred to note (A) at the end of this series of papers.

I have found it very convenient to use a board drilled with numerous small holes, into which wires may be inserted, to represent lines, and their extremities to represent points; and to represent the lines which do not lie in the plane of the board, or perpendicular to it, by threads carried from point to point of the several wires. When the line is to be inclined to the plane, it is only necessary to bend the wire at its juncture with the surface of the board into the required inclination by means of pliers. Figures of great complexity may be thus constructed with sufficient accuracy for the purpose we have in view: and even when curves are concerned in our inquiry, they can be easily formed either of discs or of wire, and placed in their proper situations. I can speak with that confidence which many years' experience justifies, of the efficiency of this method for private study.

At the same time this method is not so convenient for a class lecture as the use of paper models, since this being seen from various points of view by the class, and being moreover not well adapted to the attachment of letters of reference, it will not be so distinctly explanatory as the models which can be handed round to the members of the class in succession. In class-examinations, too, each student should come provided with his own models—models made by himself, and lettered in conformity with those employed by the examiner.

After all, the student is recommended to acquire the power of partially dispensing with his models as rapidly as he can, consistently with a full and clear conception of the figures which constitute the objects of his study. He should also accustom himself in all cases to make the diagram-representation of his model, and to construct the model itself from the diagrams presented to him in connection with their defining conditions. This double process will give him facility in forming the diagrams for explaining his own, and in conceiving the figures given by writers in illustration of their investigations. It will, in short, gradually render him independent of his models,—except, perhaps, occasionally, in totally new and complicated inquiries.

The student is strongly cautioned against supposing that the substance of this first series is in the slightest degree of a *practical* character. None of the operations prescribed in the postulates or in the problems are intended to be performed with a view to any practical uses in the arts of life. In this respect, they are mere hypo-

thetical operations,—such, indeed, as can be performed in the model for the purposes of study, but which cannot be effected by any means which may render them subservient to ordinary social or mechanical purposes. For such purposes, other and more effective methods will be given in the subsequent parts of the series. Only such constructions are here given as are rendered necessary in the preparation of a hypothetical figure for the demonstration of an *enunciated property*. No one would consider Euclid's first six books to be a treatise of *practical geometry;* for all the *problems* which he gives are solely given for their merely *subsidiary* employment in the demonstration of subsequent theorems in his work. His constructions are only, and guardedly, hypothetical in their very form; for the postulates on which they are founded are so. By assuming the use of instruments which shall fulfil the conditions of practically constructing figures which he makes postulatory, his processes are, indeed, converted into practical geometry; and so, too, could we devise instruments for accomplishing the purposes that are postulated here, we may convert the problems which follow into a body of practical solid geometry. This, however, is practically inconvenient in all cases, and impossible in the greater number.

The processes to be *practically* adopted, whatever they may be, will render a somewhat extended acquaintance with the *properties of figures in space* not only advantageous, but indispensable. The operations prescribed in this branch of geometry will be superseded by others which are strictly graphic, and which perfectly define the figure; but these substituted operations can neither be understood, nor performed with confidence, till we are familiarised with the properties of the figures themselves, as they exist in space. Any attempt to proceed to the principles or practice of descriptive geometry without this preliminary knowledge, will be altogether useless, and the time so spent be utterly wasted. In fact, any such attempt would justly lay the student open to the charge of gross misconception or deliberate empiricism.

Definitions.

1. *Parallel planes* are such, as being ever so far produced in all possible directions, will never meet.

2. *A line and plane are parallel,* when being ever so far produced in all possible directions, they will never meet.

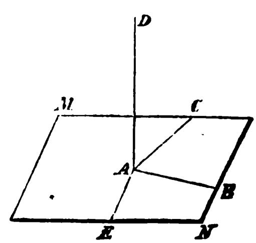
3. *A dihedral angle* is formed by two planes which intersect; and the line of intersection is called the *edge of the angle.*

Note. It is to the *inclination* of the planes that all inquiries concerning the dihedral angle are confined. (*See note B.*)

4. If the adjacent dihedral angles, made by one plane cutting another, be equal to one another, these are *dihedral right angles;* and the planes are said to be *mutually perpendicular to one another.*

5. If two lines which meet be situated in a plane, and a third line through their intersection be perpendicular to both, then the *line* which is perpendicular to both the lines, is said to be *perpendicular to the plane,* and *conversely the plane to be perpendicular to the line.*

Thus, if AD be perpendicular to AB, AC lines in the plane MN, the line AD and plane MN are mutually perpendicular.



It will be shown in *prop.* 26 that the straight line AD is perpendicular to every straight line, as AE, drawn through A in the plane MN. Euclid's definition, which is that generally adopted, is founded on this property.

6. A line which is neither parallel nor perpendicular to a plane, is said to be *inclined to the plane,* or to be *an oblique line.*

The inclination of a line to a plane requires to be fixed by convention (see note B); and that which has been se-

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lected—for its convenience, no doubt—is given in the two following definitions:

7. If from any point in an oblique line another line be drawn perpendicular to the plane, the plane drawn through the lines is called the profile plane of the line, and its intersection with the first plane, the *profile trace*, or *orthojection** of the line. The segment of the orthojection, which makes an acute angle with the line, is the *acute trace*, and the other the *obtuse trace*.

8. The *inclination*, or *profile angle of a line*, is the plane angle formed by the line and its orthojection or profile trace. It is called the *acute* or the *obtuse* profile angle, according as the line is referred to the acute or obtuse *trace*.

9. When some principal plane is taken as that to which other figures (as lines and planes, &c.) are referred, the intersections of this plane by those lines and planes, are called the *traces* of those lines and of those planes respectively.

This term is one of general usage in the descriptive geometry; but it has not hitherto been transplanted into the usual works on the geometry of space published in this country. It is, however, a very convenient one; but from the circumstances just mentioned, it is here used but sparingly. Even when it does occur, it has a prospective reference.

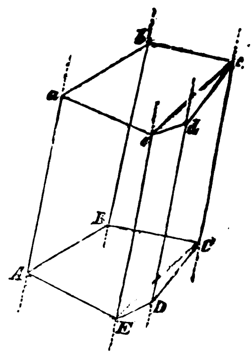
10. A *solid angle*, or, more descriptively, a *polyhedral angle*, is formed by three or more planes which meet in one point, and each plane limited, in its expansion by its intersection with the two adjacant ones. (*See note B.*)

When there are only three planes, the angle is called *trihedral;* and the greater part of the researches in which it is found necessary to engage, only require the consideration of this particular species of polyhedral angle.

11. Let any number of planes intersect each of the two adjacent ones, so that each of the remaining intersections shall be parallel to one of them: and let this system of planes be cut by any two parallel planes: then the figure thus formed is called a *prism*.

In general, the planes are all considered to be limited, each by its intersections with the adjacent ones: the parallel planes are called the *ends of the prism*, (or one of them, separately considered, the *base of the prism*); the other planes are called the *faces of the prism;* and the lines in which they intersect, the edges. It takes its name from the figure of its ends.

Thus, if the five planes—A*b*, B*c*, C*d*, D*e*, E*a*—intersect in the lines B*b*, C*c*, D*d*, E*e*, A*a*, so that the first four be each parallel to the fifth, A*a;* and if the parallel planes cut these in the pentagons ABCDE, *abcde*, the entire figure is a *pentagonal prism.*



The planes A*b*, B*c*, &c., are its *faces;* the lines A*a*, B*b*, &c., are its edges; and the pentagons ABCDE, *abcde*, are its *ends*, either of which may be considered as a *base.*

When the faces (or the edges, which implies the same thing) are perpendicular to the base, it is a *right prism;* when oblique, an *oblique prism.*

12. Let any number of planes meet in a point, and each intersect the two adjacent ones; and let this system of planes be cut by another plane; then the entire figure thus formed is called a *pyramid;* the point in which the planes meet the *vertex;* the plane which cuts them, the *base;* and the lines in which the planes intersect, the *edges* of the pyramid.

Each of the planes which passes through the point is considered to be limited in its expansion by its intersections with the two adjacent ones; but the faces are considered capable of being extended as far as the lines which constitute the edges are extended. Its name is taken from the figure of its base.

* The classical character of this term may be disputed; but it is certainly not more objectionable than the compound term *orthographic projection*, of which it is merely an abbreviation.

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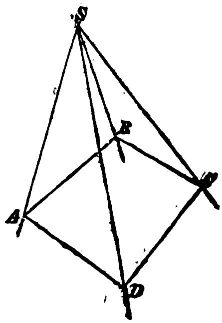
Thus, in the annexed figure, the *four planes*, ASB, BSC, CSD, DSA, meeting in the *vertex* S, intersecting in the *edges* BS, CS, DS, AS, and cut by the plane of the *base* in the quadrilateral ABCD, taken together, constitute a *quadrangular prism.*



When the base is a regular figure, (that is, equilateral and equiangular,) and the vertex is in a line perpendicular to the plane of the base, and passing through the centre of the circumscribed circle, it is called a *right pyramid.* It is seldom necessary, however, to make this distinction.

13. Let a line move parallel to a given line, and pass successively over the circumference of a circle not in the same plane with the given line: it will generate a *cylindric surface.* The circle is called its *directrix*, and the moving line its *generatrix.*

If this surface be cut by planes parallel to the directrix, the portion thus cut off is called a *cylinder;* the two planes are called its *ends*, or one of them alone, its *base;* and a line parallel to the generatrix through the centre, its *axis.*

By the *surface of the cylinder* is usually meant the curved portion of it; and when the two ends are also taken into consideration, the *entire surface of the cylinder* is the phrase used to express it.

14. If the generatrix in the last definition instead of moving parallel to a given line, always pass through a given point without the plane of the circle, it generates a *conical surface.* The circle is called the *directrix;* the point about which the generatrix moves, the *vertex;* and the line through the centre of the circle and the vertex, the *axis* of the conical surface.

When the figure is limited by the vertex and directrix, the figure is called a *cone,* and the circle the *base of the cone.* For most purposes of research, however, it is found necessary to consider the conical surface as indefinitely extended in all directions, or, in other words, to divest the cone of all restrictions as to limitation.

Any position of the generatrix of the conical and cylindrical surface when referred to the cone and cylinder, is called an *edge.*

When the axis of the cone is at right angles to the base, it is called a *right cone;* and when oblique to the base, an *oblique cone.*

Note. Other figures than the circle may be taken as the directrices of the cylinder and cone; and they need not be curves situated in a single plane, but such as continually change their planes from point to point. They will be duly noticed when we shall have arrived at the state of their occurrence.

15. If a circle revolve about any diameter till its plane has taken a reversed position (or a semicircle take an entire revolution about its diameter) a *spherical surface*, or *sphere*, will be generated.

The centre of the circle is the *centre of the sphere;* any line through its centre, limited by the surface, is a *diameter;* and that particular diameter about which it was conceived to be generated, is the *axis* of the *sphere.* This, of course, might be any diameter whatever.

16. A *polyhedron* is a figure bounded by any number of plane faces.

The prism and pyramid are particular specimens of the polyhedron. There are, however, some particular polyhedrons, which from their continual occurrence have received especial names. With respect to our present purpose, the following are to be noticed.

(*a.*) The *tetrahedron*, or *triangular pyramid;* that is a four-faced figure, or a pyramid on a triangular base. When the four faces are equilateral triangles, it is a *regular tetrahedron*, and forms the first of the five "Platonic bodies."

(*b.*) The *hexahedron*, or six faced figure. The general figure possesses no geo-

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metrical interest or use; but several special varieties are of the highest importance.

When the six faces are constituted of three pairs of parallel planes, no pair being parallel to another, the figure is the *parallelopiped.* It is the *right* parallelopiped when the three pairs of faces are mutually perpendicular; and *the oblique parallelopiped* when the faces are oblique.

When the right parallelopiped has the distances of the opposite faces all equal, it is the *cube;* or the hexahedron of the "Platonic bodies."

None of the other figures have in their general form any claim upon our present attention; but when the faces are regular, and equal figures, they possess interest. They are the remaning three of the "Platonic bodies."

(*c.*) The *octahedron*, bounded by eight equilateral triangles.

(*d.*) The *dodecahedron*, bounded by twelve regular pentagons.

(*e.*) The *icosahedron* bounded by twenty equilateral triangles.

Several forms, in which the faces are symmetrical with respect to some point, line, or plane, but which are not all regular polygons, or even polygons with the same number of sides, occur in crystallography, and have received distinct names. For these, reference may be made to the "*Solid Geometry*" of Mr. N. J. Larkin; in which the principal relations of most of the solids that have been detected in crystals are numerically given.

17. Two polyhedrons which are *similar* (or are of the *same form*) have their corresponding faces similar figures, their corresponding dihedral angles equal, and their corresponding polyhedral angles equal.

This is, perhaps, not so much a definition, in the ordinary sense of the term, as a description of the similar polyhedrons. It is a condition fulfilled by all similar polyhedrons; but the number of conditions that shall render two figures similar is smaller than the number of separate parts of which each figure is composed. It is analogous to the case of two similar plane polygons; where, also, the number of necessary conditions for fixing the similarity is less than the total number of sides and angles in each of the two figures. Let, then, the description above be understood as a property to be fulfilled by two similar polyhedrons, rather than as that by which they are to be laid down in respect of absolute geometrical conditions.

It may be viewed as analogous to Euclid's definition of a square, of a cube, or of ratio: merely to assist our early conception of the things spoken of.

18. When a plane is revolved about its trace upon another plane till it is brought into coincidence with that other plane, the former is said to be *rabatted* on the latter; and the process of revolution is called *rabattment.** Often the rabattment is made of a line upon a plane, the revolution being performed in a plane drawn at right angles to the given one through the line itself; and a plane is said, also, to be *rabatted* when it is so revolved as to be brought into parallelism with another given plane. The term is not, however, so used in this work, and is noticed here merely to render passages in different foreign works intelligible.

19. A point is said to be *projected* in a plane when a line is drawn through it, either parallel to a given line, or through a given point; the line thus drawn through it is called the *projector*, and the point in which it cuts the plane is called the *projection* of that point. The plane itself is called the *plane of projection.*

When a line or curve is projected, and the projectors all pass through a given fixed point, the projection is said to be *polar*, *radial*, and often, *conical.* The last is inappropriate, except the figure to be projected be curvilinear.

When a line or curve is projected by lines drawn through every point parallel to some fixed line, the projection will take the name of *parajection;* and when the pattern line is perpendicular to the plane of projection, the term used is *orthojection.*

Projections are sometimes made on other surfaces besides a plane. The method, however, takes no specific name from this circumstance.

* I have here proposed to naturalize the French term *rabattement*, as expressive of an operation which we have no means of designating but by a circumlocution. There can be no doubt that the technical term in use amongst English workmen, to "rabbet," had its origin in the same root: but it does not "read in" well; and it is, probably, better to go back to the original form. It has been proposed to me to use the verbal form "to floor," which has very nearly the same meaning: but to this there are more objections than one. The term, as given above, is *universally* used by the French writers on Descriptive Geometry; which, to my mind, is sufficient to decide our own preference of it.

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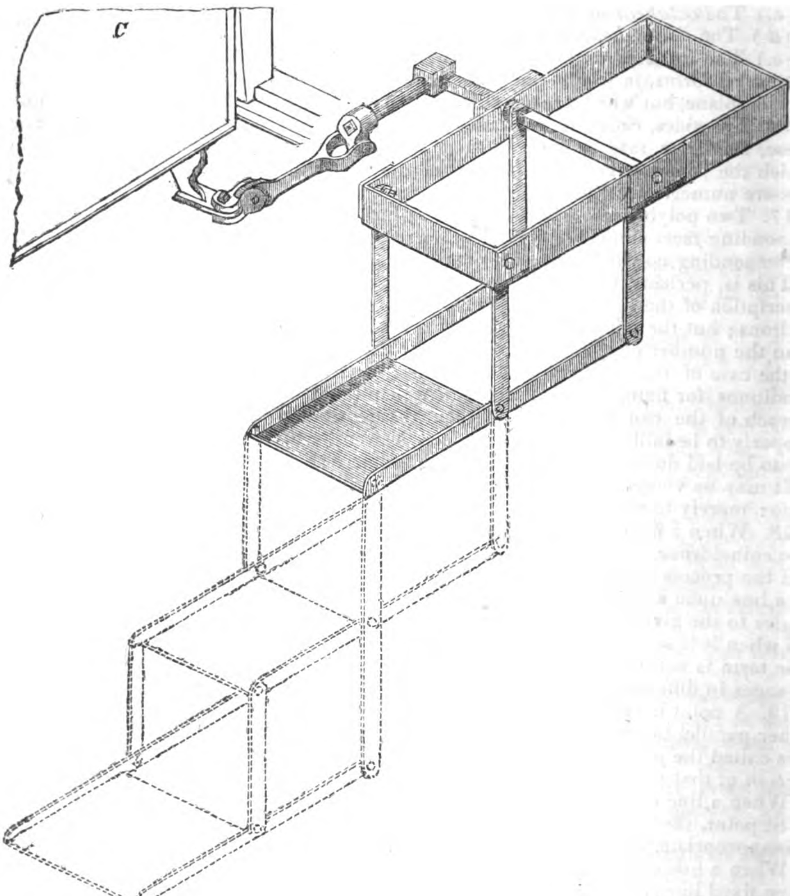
When a polyhedron, or any system of lines and intersecting planes, is projected, the projection of the boundaries, and of any remarkable points connected with the system of lines and planes, is alone to be understood as spoken of or discussed.

Frequently only the contour, or, so to speak, the shadow of the figure, is spoken of under the term projection. The context will always decide the exact sense in which the word is to be understood in every special case.—(*To be continued.*)

DAVIES'S PATENT ATHEKTOBATHRON, OR MAGIC STEP.

(Patent sealed September 17th, 1846.)

Fig. 3.



The gentleman to whom we are indebted for this important improvement (Mr. David Davies, of Wigmore-street) is well known in the higher circles, as the inventor of the *Pilentum*, *Basterna*, and other favourite and fashionable carriages, and, to the travelling public, as the builder of those substantial carriages employed upon the Great Western Railway, the excellent construction of which, on the occasion of a notable accident, averted fatal consequences. Mr. Davies is also favourably known as the inventor of one of the best railway breaks hitherto employed.

The first idea of the "Athektoba-

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thron,* or Magic Step, which forms the subject of the present patent, was communicated by a gentleman at Strasburg; but so crude and undigested was the original plan, that great mechanical skill and ingenuity were required to make it practically applicable to the intended purpose. It is a somewhat singular circumstance, that, notwithstanding the vast amount of talent that has been constantly directed to the improvement of carriage-building in all its multifarious details, the

Figs. 1.

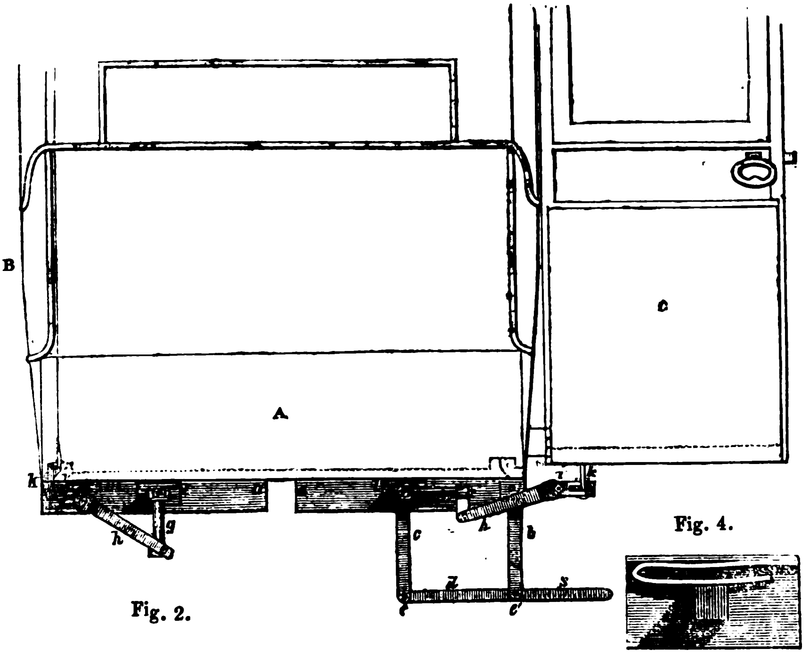

Fig. 2.

Fig. 4.

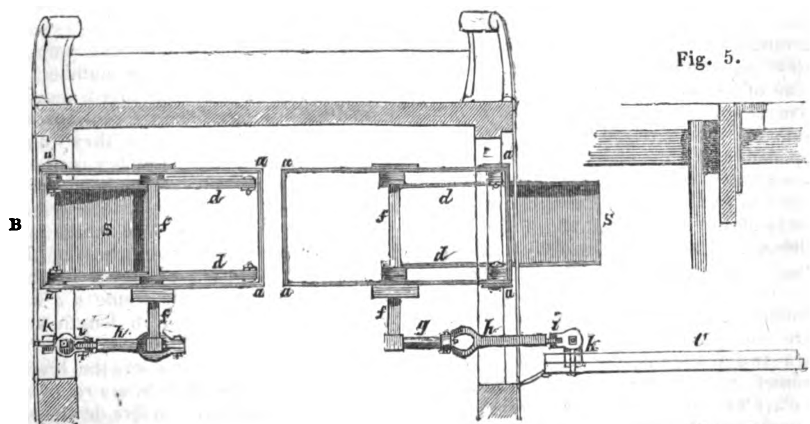

Fig. 5.

step is a part that has been almost entirely neglected. The old-fashioned two-fold step, still found in the best and largest carriages, occupies a most objectionable space within each side of the

* A compound Greek word, signifying literally, "a step not requiring to be touched with the hand."

carriage-body; these steps are cumbrous and inconvenient in use, and render external assistance indispensable. In modern carriages, where the body is so low that a single step will afford the required accommodation, the internal inconvenience has been exchanged for an external nuisance—for in no other light can the external fixed step be regarded. It is an unsightly appendage, fraught with danger, and always covered with dirt, unless, as is often done, a supplemental nuisance in the shape of a step-cover is affixed to the carriage door.

In Mr. Davies's improved step there is no incumbrance either internally or externally; the steps lie folded up beneath the carriage body, out of the way, invisible, and protected from dirt. From this snug depository the steps are projected by the act of opening the carriage door, the shutting of which again returns them to their original position.

To professional men and others who let themselves into and out of their carriages, the "Magic Step" is an unspeakable convenience; it is universally applicable, and forms an invaluable appendage to every description of pleasure carriage.

The following description of Mr. Davies's improvements is extracted from his specification, and the step itself may be seen in action at his manufactory, Wigmore-street:

"Figure 1 is a hind elevation of so much of the body of a carriage as is necessary to show the construction and arrangement of my improvements in steps as applied thereto. Fig. 2 is a plan of the same; and fig. 3 a perspective representation of a portion of one side of the carriage, with the door opened and the steps lowered. The same letters of reference apply to similar parts in each of these figures. A is the body of the carriage, B and C the doors thereof. Beneath the body of the carriage on each side, is fixed a quadrangular iron box or frame, *a*, *a*, *a*, *a*, within which the step and its supporting levers are contained when closed up. *b b* are two perpendicular bars, or levers, jointed to the frame *a a* by bolts at *b'*. *c c* are two similar bars, or levers, fixed upon a square iron shaft *f*, which turns in bearings in the side of the frame *a a* at *c' c'*. A step S is supported upon two horizontal bars *d d*, jointed by bolts to the vertical bars *b b*, *c c*, and *e* and *e'*. As a necessary consequence of this arrangement, the bars, *b b* and *c c*, always move parallel to each other, and the step-bar *d d* parallel to the frame *a a*. On one end of the shaft *f* is fixed a lever *g*, at right angles to the bars *c c*; and at the outer extremity of the lever *g* there is a short connecting piece which is jointed between the forked extremity of a link-bar *h*. To the carriage-door is fixed a metal step-piece *k*, which is jointed by a right angled connecting link *i*, to the end of the forked link-bar *h*.

"While the carriage door is shut, these several parts remain in the position shown on the left-hand side of figs. 1 and 2; the levers *b b*, *c c*, and *d d*, being closed up within the frame *a a*, the lever *g* in a vertical, and the link-bar *h* in an inclined position, the extremity of the lever *g* passing down through the forked opening left at the end of the bar *h* for that purpose. On opening the carriage door, the step-piece *k*, by means of the connecting-link *i*, draws the bar *h* forward, and raises the lever *g* into the horizontal position, which turning the shaft *f*, depresses the levers *b b* and *c c*, until they come into a vertical position and stop against the front of the frame *a a*. By this movement the step S is projected from beneath the body of the carriage into the position shown on the right-hand side of the figs. 1 and 2; and still more distinctly in the perspective representation, fig. 3.

"In these figures only one step is shown as being used; any number of steps may, however, be employed, and the dotted lines in fig. 3 show a continuation of the levers and steps, as they would appear when a larger number is used; the construction and action being precisely the same as before described and shown, but extended so much farther as to meet the requirements of the case. If more than one step is employed, the size of the frame *a a* will require to be increased in length and depth, according to the number of steps. On closing the carriage-door, the levers *b b*, *c c*, *d d*, and the step S, are returned up into the frame *a a*, as before described.

"In order to keep the step firm in its position when up or down, a strong bent steel spring is placed at *l*, which pressing upon the square of the shaft *f*, prevents its moving until acted upon by the lever

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g. The form and position of the spring are shown on an enlarged scale in figs. 4 and 5; the former being a back view, and fig. 5 an end view of the shaft. Or, instead of one spring, two may be used, one placed above, the other beneath the shaft; and it is preferred to use two springs thus arranged when more than one step is employed.

"In carriages which have no doors (such as phaetons for instance) a similar arrangement of step may be employed, to be raised and lowered by a suitable handle attached directly to the lever *g*, or acting upon the shaft *f* through the medium of any of the well-known mechanical powers, and worked either by the parties using the carriage, or by the driver thereof, as may be preferred."

In illustration of "other useful purposes" to which the preceding improvements in steps are also applicable, the inventor instances "the back-door of a house or other building opening into a yard or garden on a lower level. If the improved steps were applied to such a door, on opening it, the steps would be let down and afford a convenient means of ascent or descent, but on closing the door the steps would be withdrawn up into the framing or recess provided for their reception, and communication from below would be cut off."

Again: "as a means of escape from fire, in a building which is higher than, or detached from those adjoining, the improved steps may be used with much advantage. A door at the upper part of the building being fitted with such an arrangement of steps would, when opened, project the steps, and present a safe means of descent for the inmates; while the closing of the door would, at other times, withdraw the steps, and cut off all communication from the adjoining premises. Such an extended application of the improved steps would resemble that shown at fig. 3 of the annexed drawings." B.

MARINE AND RAILWAY, DAY AND NIGHT TELEGRAPHS.

Sir,—May I be allowed, through the medium of your useful and valuable Magazine, to submit, as far as I have been able to ascertain, a novel plan for effecting communication between vessels at sea, or between them and the shores at night, and between the passengers, guards, and engine-drivers of railways, or between the trains and stations, either by day or night. I am aware that various schemes have been proposed to effect communications at night, &c., by means of variegated lamps—especially by General Pasley, in his Universal Telegraph; but all to a very great extent depending upon multiplicity of signs, rather than on the combination of the movements or position of a few signs. We need no better proof of the superiority of the last-mentioned method of obtaining a diversity of signals, than in the Electric Telegraph, which, for many years, remained *in statu quo*, in consequence of the great expense which its construction would have involved, from the multiplicity of needles and wires deemed necessary to give the whole alphabet, or even to give a few conventional signals. But at length ingenuity has triumphed, inasmuch as that we have now the whole alphabet expressed by the simple and combined deflections of a single needle, or pointer, and requiring but one telegraphic wire. It is indeed alleged by some that this method of telegraphing is complicated and dubious. However, I am inclined to believe that the needle apparatus possesses the avowed requisites of a TELEGRAPH for all purposes, viz., power, certainty, simplicity, celerity, and secrecy, to a far greater extent than any other telegraph hitherto introduced.

The following simple movements and combinations would indicate the whole alphabet, whether the signs be two dissimilar coloured lights, or flags: The bright light, or white flag, would, during the operation of telegraphing, remain permanently exposed, and the signals would be read from the relative position of the red moving light or flag, to the stationary light or flag; for instance, a momentary appearance of the *red light above* the *bright light* would indicate A, to the *left* B, *below* C, to the *right* D, *above* and immediately moving to the *right* thereof and disappearing E, *above* and *below* ditto F, *above* and *left* ditto G, *right* and *below* ditto H, *right* and *left* ditto I, *right* and *above* ditto K, *below* and *left* ditto L, *below* and *above* ditto M, *below and right* ditto N, *left* and *above* ditto O, *left* and *right* ditto P, *left and below* ditto R, *twice* successively *above* S, *twice* ditto *right* T,

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twice ditto *below* U, *twice* ditto *left* W, *three times* ditto *above* X, *three times* ditto *right* Y, *three times* ditto *below* YES, three times ditto left No, *twice above* and once *below* FIGURES, which would be indicated by the same movements as those which form the first ten letters of the Alphabet. And if necessary by changing and combining the positions of the first four simple signals a great number of sentences could be expressed. Suppose A and B were given, on referring to an arranged code of signals, I would find that the message represented by the combination was "*Our vessel is short of provision;*" again, B and A would indicate another signal, such as "*A boat is wanted,*" &c. If every railway carriage were supplied with a small flag for the day, and a small lamp for the night, to be exhibited in cases of danger by the passengers, either through the windows, or through an aperture made for that purpose in the roof, with printed direction fixed in each carriage how to exhibit the same, so as to communicate one of two requests, namely, "*Stop at next station,*" or "*Stop immediately*"—I am led to believe that the adoption of some such simple plan would increase the confidence of travellers, if not be the means of preventing accidents and saving many lives; of course it would be necessary that the drivers, guards, and stokers, should cast their eyes at intervals along the train in anticipation of such signals. As I do not aspire to a greater amount of fame than that which a sense of duty towards my fellow-creatures entitles me to receive, I trust that your numerous and intelligent readers will try to improve these suggestions if practicable, and not disdain an attempt made to promote the public benefit.

I am, Sir, yours, &c.,

O. R.

MR. JACOB BRETT'S ELECTRIC PRINTING TELEGRAPH.

Sir,—In reply to the remarks of "Tyro Electricus" on my objections to Cooke and Wheatstone's system of Electro-telegraphy, I beg to say that I refrained from alluding to their single-wire instruments, simply because the one on the South Eastern Railway was only a section of their double-needle telegraph, and, like their other single-wire telegraphs, infinitely slower in communicating signals than their double-needle telegraph, and which I considered unjust to place in juxtaposition with the subitaneous system of Mr. Brett. Had their printing telegraph been a "second Dromio" to Mr. Brett's, it never would have been laid by in a glass case for so long a period, after having accomplished the extraordinary task of printing from 10 to 15 letters per minute! It is, in reality, nothing more than a slight modification of their Magneto-electric telegraph, and subject to the like uncertainty in its manipulation, of which Mr. C. V. Walker gave ocular demonstration on Friday evening (May 28th) to the Members of the Royal Society, by trying to make certain letters, when, instead of that which should have appeared, the letter in advance, or the one in the rear, was shown.

Why has "Tyro Electricus" left my 2nd, 6th, and 7th objections unnoticed? Why has he blended my 3rd with my 4th objection? Why has he avoided my 5th, by asking for the principles of a rival system? Why does he not attack more generally the statements of my 8th, 9th, and 12th objections? And why has he neglected to refute the statements in any of my objections? Is it because he has been lately reminded by "E. Moses and Son," in large characters, that "Facts, facts, facts, are incontrovertible"? Taking it for granted such to be the case, I will confine myself to his remarks as he has been pleased to make them. Proceeding, then, to answer those of the 3rd and 4th, I have the pleasure of informing him, that the secretary to the Electric Printing Telegraph Company has, by the last mail, received a letter from a railway company in Canada, stating that they had, six months previously, made arrangements for the construction of a line of telegraph on Professor Morse's principle, but had postponed, it on account of the risk of the wires being cut, which had frequently occurred to lines of telegraph on the suspension principle in America; and they did feel confident in the safety of Brett's system, namely, "in the subterranean line." This line being buried considerably below the level of the rails, is not liable to damage from "the pick or spade of any mischievous navvie," or from "the subsidence of an embankment." Need I tell this would-be student in electricity, that the more desperate the accident, the greater would be the amount of insulation removed from the wires; which would tend to insure a better contact between the wires and the earth, forming, as I before said, circuits up and down the line from the place of accident. The place of accident will be as readily discovered by the testing-posts, at

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intervals of the line, as by a suspension system, although above ground and visible.

In answer to the 5th, the pneumatic apparatus named is of great importance as regards the certainty of printing the desired letters only, and which is effected by an arrangement of the hydraulic piston in connection with a throttle-valve. The said piston when lifted by means of the atmospheric pressure, causes the throttle-valve to be raised, and thereby takes off the pressure from the type wheel of the printing machine, thus forming part of the motive power.

For answers to the remarks on my 8th objection, I beg to refer your correspondent to the current volume of yeur journal, page 400; and in corroboration of the statements therein contained, I could name two persons holding no inferior situations in the service of the Electric Telegraph Company who were unable to receive a communication in the presence, if I mistake not, of "Tyro Electricus" himself, and when I was called forward to accomplish the same.

Although "Tyro Electricus" may doubt my assertion that Mr. Jacob Brett's telegraphic machines, for general purposes, would compose and print from 100 to 300 letters a minute; and that he could, by the aid of further improvements, produce machines adapted for special purposes, capable of printing from 300 to 3000 letters per minute—I trust, at some future period, to have the opportunity of proving its truth, and the wonderful merits of this invention; but at present I have only to deal with the machines for general purposes, which are far superior to Cooke and Wheatstone's instruments, as has been undeniably proved whenever they are put to the test. Having previously shown some of its advantages as regards the economy of time (see my 9th objection, page 466), it only now remains for me to give an example. For this purpose I now send you a copy of a letter to Sir Robert Peel, Bart., consisting of 394 words, or 1966 letters, which was composed, printed, and transmitted in 28 minutes and 26 seconds, including 496 stops, spaces, and justifications, making a total of 2462 attractions and repulsions, being an equivalent to 87 letters per minute. Supposing, under the most favourable circumstances, that it were possible, by Cooke and Wheatstone's system, to transmit these 1966 letters without repeating any of them, the deflections of the needles would even then amount to 3612; for the formation of which into words, the deflections would increase to 394—it being necessary to divide each word by one deflection ("stop)", and also for the recipient to acknowledge each word by another deflection ("understand", or not "understand"), amounting to 394 more deflections, together with 60 deflections for preparatory signals, and 19 deflections for figures—the total amount 4478 deflections; and wherever the numerals are spelt (which is a general practice) make an increase of 108 deflections, making the total deflections 4587; which, according to their own calculation of 40 letters per minute, it would take as much as 1h. 54m. 27s. to transmit the same without making any calculation of the time occupied in copying and re-copying, which, at the very least, would take half an hour more, making a total of 2h. 24m. 27s.

By Brett's system the following letter was completed in less than half an hour with certainty, which by Cooke and Wheatstone's system takes 2h. 24m. 27s., attended with uncertainty.

I am, Sir, yours, &c.,
W. H. French.

14, James street, Covent-garden,
June 2, 1847.

Copy of a Letter submitted to the Government in July, 1845. Printed by Brett's Electric Telegraph.

To the Right Hon. Sir Robert Peel, Bart.

London, July, 1845,

We beg the honour to submit a plan for general communication by means of oceanic, and subterranean inland electric telegraphs. For which patents have been secured by the undersigned, and for their construction on cheap and efficient plans.

By means of this telegraph, any communication may be instantly transmitted from London, or any other place, and delivered in a printed form, almost at the same instant of time, at the most distant parts of the united kingdom, or of the colonies.

The advantage and power offered to the government by this invention render it of the greatest importance that they should have it under their own control, and arrange and conduct this plan of general telegraphic communication.

The following few of the advantages offered by this patent:

1. The immediate communication of government orders and despatches to all parts of the empire, and the instant return of answers to the same, from the seats of local government, etc., all delivered in an unerring and printed form.

2. A general telegraphic post office system, uniting the chief and branch offices in London, in connection with all the offices throughout the kingdom, for transmitting messages of business, etc., from merchants, brokers, tradesmen, and private persons, at a fixed rate of charge. These communications would be printed on paper and all enclosed in sealed envelopes, and addressed by confidential clerks, and issued by special messengers, or the usual post office delivery.

3. The advantages of this plan applied to police arrangements throughout the united kingdom, and to the army and navy departments, must be at once obvious to the government. By it instructions might be conveyed instantaneously, and the movements of the forces so regulated that any available number of them may be brought together at any given point in the shortest possible time necessary for their conveyance.

These are some of the advantages, others readily suggest themselves, namely, general communica-

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ion between stations on the coast, such as lighthouses, channel islands, etc., so that a general supervision of the coast might be obtained for the use of the navy, Lloyds, and for the prevention of smuggling, etc.

Signed J. and J. W. BRETT,
No. 2, Hanover-square.

MATHEMATICS AT ASCOT.

Sir,—My attention was first called to mathematical studies, of which I was previously utterly innocent, by my receiving (through a friend I had assisted in a railway spec.) the appointment of sub-engineer on the Glenmutchkin line, since which time I have thought it proper to pay more attention to them, and especially to the doctrine of chances, as I thought it probable it might afford me some assistance in my various speculations. Before, however, I had gone deeply into the matter, the change that came over the spirit of railway affairs, made it prudent for me to retire from this country for a season; and it was only last month that, with a new name and luxuriant moustaches, I ventured to return.

As all hopes of railway prosperity are, for the present, blighted, and I never *was* fond of active employment, I have given up stags for horses, and hope to turn my scientific acquirements to some account on the turf, and thereby secure myself a gentlemanly independence. The following is an abstract of my book on the Ascot stakes:—

I have taken

£2640	to	£440	against	Humdrum	at	6 to 1
2720	to	340	,,	Odessa	at	8 to 1
2720	to	320	,,	Vampire	at	17 to 2
2790	to	310	,,	Clermont	at	9 to 1
2800	to	280	,,	Hydrangea	at	10 to 1
2660	to	380	,,	any other	at	7 to 1

So that I am certain of as nearly £1000 as may be, whichever horse wins; for instance, if Vampire wins (and if every one pays me—I hope there are not many Mr. P.'s)—

		I receive	£2720
and lose on	Humdrum	£440	
,, on	Odessa	340	
,, on	Clement	310	
,, on	Hydrangea	280	
,, on	the ruck	380	1750
		So I win	£970

This is not quite my thousand, but my gentlemanly feelings prevented my betting out of round numbers. You will find the amount about the same in all the other cases.

As I am not selfish (witness the cause of my sub-engineer's appointment) I annex a formula for winning that may be found serviceable, and remain, with brilliant prospects for settling day,

Your obedient servant,

J. E.

May 31, 1847.

Let the odds against the various horses (which must always be taken and not given) be represented by, and call your bets

a to 1	va to v
b to 1	xb to x
c to 1	yc to y
d to 1 &c., &c.	zd to z &c., &c.

and let s represent the the sum to be won, which ever horse comes in first. Then x will be equal to $v\left(\frac{a+1}{b+1}\right)$

$$y=v\left(\frac{a+1}{c+1}\right) \text{ and } z=v\left(\frac{a+1}{d+1}\right), \text{ \&c., \&c.,}$$

and the value of v may be found from the following equation:

$$av-\left(v\left(\frac{a+1}{b+1}\right)+v\left(\frac{a+1}{c+1}\right)+v\left(\frac{a+1}{a+1}\right)+\ldots\ldots\right)=s.$$

READE'S PATENT INKS AND NEW SALTS OF GOLD.

[Patent dated 3rd December, 1846; Specification enrolled 3rd June, 1847. Patentee, Rev. J. B. Reade, of Stone Vicarage, Aylesbury.]

The present specification discloses processes for making both writing and printing inks—black, blue, and red—and also marking inks—of a much superior quality to any yet known. We say this advisedly, for, the patentee—unlike the majority of would-be improvers in this branch of manufactures—can give, and does give, *the sufficient reason* for the superiority which he claims in each case. His writing inks are superior, because they are proof both against acids and alkalies, and especially fit, therefore, for use with steel pens; his printing inks, because they are made mostly from the same materials as the writing inks, with the substitution of water for oil, and the addition of a few ingredients in perfect chemical harmony with the others; and his marking inks, because in one case the acid essential to this class of inks is neutralized, and in another, because the compound is such that it cannot be acted on by any of the common salts of silver, such as cyanide of potassium, or chloride of lime.

Some of Mr. Reade's processes will be new to the chemical world; his process, in particular, of obtaining a soluble prussiate of blue, which it will be seen affords some reason for believing that Davy was right, after all, in questioning the elementary character of iodine.

In the course of his experiments, Mr. Reade has discovered two new salts of gold, of a very interesting character, which he has named ammonio-iodide and ammonio-periodide of gold.

We subjoin all the material parts of Mr. Reade's specification in his own words:—

Firstly, I manufacture, in manner following, a blue writing ink, which is wholly free from acid, and therefore well adapted for use with steel pens. I first obtain a solution of iodide of iron by the process ordinarily followed for that purpose, and then dissolve therein half the weight of iodine already employed. I next pour this mixture into a semi-saturated solution of yellow prussiate of potash, employing a weight of this salt nearly equal to the whole weight of iodine used in the above iodine solution. A decomposition of the materials, thus brought together, immediately takes place, when the cyanogen (of the prussiate of potash) and iron combine, and are precipitated in a solid form, and the potassium (of the prussiate) and iodine combine to form a neutral iodine of potassium, which remains in solution with a little excess of iodide of iron. I next filter and wash the solid precipitate of cyanogen and iron, (which is soluble Prussian blue,) and finally dissolve it in water, which forms the blue ink required. In this process, it will be observed that neither any acid nor persalt of iron is employed, as is usual in the formation of Prussian blue.

I was led to these results by a microscopical examination of the metallic colours in salts of the ashes of plants. I employed iron and iodine to produce the same effects on pure salts; and in the course of my experiments I ascertained that these two substances (iron and iodine) have so great an affinity for each other, that when placed together without any water, or when rubbed together, they very speedily form a liquid, containing an excess of iodine in solution, which, being added to a solution of prussiate of potash, gives the compound of cyanogen and iron, or soluble Prussian blue, which has been just described. The addition of water alters the character of this iodine solution; without water, it turns litmus paper green, and with water, it has the usual acid re-action, thus apparently confirming Davy's original doubt as to the elementary character of iodine.

Secondly, I form a neutral iodide of potassium, of great purity, and wholly free from alkaline re-action, in manner following: I take the solution which remained over from the process first described, after the Prussian blue had been precipitated, which solution consisted, as before stated, of a neutral iodide of potassium, with iodide of iron in excess; and I get rid of that excess by the well-known processes of fusion and crystallization. The result is an iodide of potassium, which is as pure as when iodine and potassium are made to act directly on one another, and is perfectly free from the alkaline re-action on turmeric paper which invariably characterizes the most careful preparations of this salt when carbonate of potassa is employed (as usual) in its manufacture. It is also much less deliquescent than the ordinary iodide of potassium of commerce, and, on account of its great purity, much to be preferred in medicinal preparations.

Thirdly, I manufacture a blue ink of peculiar intensity, and, therefore, particu-

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larly suitable for printing purposes, by using the same materials, and manipulating them in the same way as first described, with the exception that for the iodine wherever it is used, I substitute bromine, and rub up the precipitate in oil.

Fourthly, I form a bromide of potassium of great purity, and wholly free from alkaline reaction, by treating the bromide of potassium, which remains over in a state of solution from the process last before described, in the same way as the iodide of potassium solution is directed to be used under the second head of this specification.

Fifthly, I manufacture a very superior black writing ink, by adding to gall ink of a good quality soluble Prussian blue described under the first head of this specification. The addition of this Prussian blue makes the ink, which was already proof against alkalies, equally proof against acids, and forms a writing fluid which cannot be erased from paper by any common method of fraudulent obliteration without the destruction of the paper.

Sixthly, I manufacture in manner following a red writing ink, which is greatly superior to the common solutions from peach wood, and Brazil wood, not only in permanent brilliancy of colour, but also in its freedom from acid, and consequent fitness for use with steel pens. I first boil cochineal repeatedly in successive quantities of pure water, till it ceases, or nearly so, to give out any colouring matter. I then boil it in water containing liquor ammoniæ, which combines after the manner of an alkali with an acid, with the residue of colouring matter, and leaves the insect matter nearly white. The liquid products of these successive boilings are then thrown together into an earthenware vessel, and in order to get rid of a peculiar element or principle still combined with the colouring matter, and which has a great affinity for iron, I precipitate the colouring matter with ammonio bichloride of tin. The precipitate is afterwards dissolved in ammonia, and protiodide of tin added, till a sufficient degree of brilliancy of colour is obtained, which completes the process, water being added *ad libitum*, according to the degree of body desired to be given to the ink.

Seventhly, I manufacture by the improved process following, a marking ink, which may be used with steel pens, and is not only of great intensity of colour, but comes out most readily on the application of heat. I rub together in a mortar nitrate of silver, and the proper equivalent of tartaric acid in a dry state. I then add water, on which crystals of tartrate of silver are formed and the nitric acid set free. I next neutralize this acid by adding liquor ammoniæ, which also dissolves the tartrate of silver. I finally add gum, colouring matter, and water, in the usual way, and in quantities which may be varied at pleasure. By this process the nitric acid, which is essential to a good marking ink, is retained, and the tartrate of silver formed is soluble in less than half the quantity of liquor ammoniæ ordinarily required when tartrate of silver is the basis of the ink. The tedious operation of filtering and washing the carbonate of silver, in order to form the tartrate, is also thereby entirely dispensed with.

Eighthly, I manufacture, in manner following, a marking ink, differing from the preceding, and all other marking inks containing salts of silver only, in this respect, that it cannot be acted upon by the common solvents of salts of silver, as cyanide of potassium or chloride of lime, and is so far, therefore, more indelible. I take the ink, as it has been formed by the process last described, and add to it an ammoniacal solution of an oxide, or salt of gold. I have used for this purpose the purple of Cassius, the hyposulphite of gold, the ammonio-iodide of gold, and the ammonio-periodide of gold. Tho two last salts, which I believe to be new salts, I obtain by dissolving iodine in liquor ammoniæ under the application of heat; an operation, however, which requires to be conducted with great caution, in order to prevent the formation of the explosive compound, the teriodide of nitrogen. This iodine solution is a very speedy solvent of gold. If gold leaf be placed upon it without the addition of water, a black oxide of gold is formed, which immediately dissolves, but if it be diluted with water, the process of oxidation is less rapid, and the gold leaf assumes a fine purple colour (not black) before solution. This salt of gold crystallizes in four-sided prisms, which are soluble in water. A few drops of this solution placed on a slip of glass generally form microscopic arborescent crystals, from which, under the application of heat, both the iodine and ammonia may be volatilized, and arborescent metallic gold alone remains. If a moderate heat only is employed, one equivalent only of iodine is dispelled, and white crystals of ammonio-iodide of gold remain.

Ninthly, I manufacture a blue printing ink by taking the soluble precipitate of cyanogen and iron, obtained by the process described under the first head of this specification, and rubbing up the same in oil, after the manner ordinarily followed in the manufacture of printing inks; or by boiling down the blue writing ink produced by the said process to a sufficient consistence, and then rubbing up the same in oil.

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Tenthly, I manufacture a black printing ink by boiling down the black writing ink produced from the materials, and by the process described under the fifth head of this specification, and rubbing it up in oil as aforesaid.

Eleventhly, I manufacture a red printing ink by taking the ammoniacal solution of cochineal, obtained by the process described under the sixth head of this specification, and rubbing it up in oil, adding protiodide of tin according to the degree of lustre required; or by boiling down the red writing ink, produced by the said process, to a sufficient consistence, and then rubbing up the same in oil as aforesaid.

And *Twelfthly*, I manufacture a black printing ink by boiling chips of logwood (for which an extract of logwood may be substituted), or other dye woods containing colouring matter and tannin, along with as much of a protosalt, or persalt of iron, or copper, or other precipitate of tannin, as will be equal to about twice the weight of the tannin contained in the wood or extract employed; whereby I obtain a black, or bluish black precipitate; the blueness of which I diminish, as may be required, by the addition of bichromate of potash, more or less. I finally rub up the whole in oil as aforesaid, adding a small quantity of the lampblack, or other black colouring matter, ordinarily employed in the manufacture of black printing inks.

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 528.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

Robert Phipps, of St. Magdalen, Milk-street, Cheapside, weaver: of a method entirely new of manufacturing silk and mohair, either separately or jointly, with materials which have never before been combined or manufactured together [as wood, reed, cane, straw, &c.], and which is called (by the specifier) "Venetian Satin." Cl. R., 26 Geo. 3, p. 21, No. 7. Nov. 7, 27, Geo. 3; Dec. 5, 1786.

John Beasant, of London, engineer: of certain improvements on wheel carriages by means of which they are less liable to overturn, will follow with less draft, go down hill without distressing the horses, and have less friction on the axle-tree than any now in use. Cl. R., 26 Geo. 3, p. 21, No. 1. Nov. 29, 27 Geo. 3; Dec. 28, 1786.

Samuel Ball, of Nottingham, frame-work knitter: of an entire new apparatus of making, inlaying, and working of hose pieces, and all other sorts of work usually made on the stocking-frame, of silk, worsted, thread, cotton, and other materials. Cl. R., 26 Geo. 3, p. 22, No. 19. Dec. 19, 26 Geo. 3; Jan. 13, 1786.

Josephly Antley, of Birmingham, spur-maker in general: of an invention of a spur, upon an entire new principle. Cl. R., 26 Geo. 3, p. 22, No. 30. March 27, 26 Geo. 3; April 3, 1786.

John Eginton, of Birmingham, engraver: of a new method of making buttons and button moulds of wood. Cl. R., 26 Geo. 3, p. 23, No. 20. Jan. 31, 26 Geo. 3; Feb. 16, 1786.

John Francis, of Birmingham, founder: of an invention of making coat, waistcoat, and sleeve buttons from pig iron, commonly called cast iron, and japanning and painting the same of different colours and devices. Cl. R., 26 Geo. 3, p. 23, No. 18. Jan. 31, 26 Geo. 3; Feb 23, 26 Geo. 3, 1786.

Thomas Cheston, of Birmingham (Warwick), plater: of an invention of making elastic spring buckles and spurs in gold, silver, iron, steel, copper, pinchbeck, or other mixed metals, to be plated with gold and silver. Cl. R., 26 Geo. 3, p. 27, No. 2. July 1, 26 Geo. 3; July 26, 26 Geo. 3, 1786.

Thomas Simpson, of the town and county of Newcastle-upon-Tyne, merchant: of a certain composition called British Smalts or Powder Blue. Cl. R., 26 Geo. 3, p. 27, No. 1. Oct. 10, instant; Oct. 28, 1786.

Thomas Robathan, of Walsall (Stafford), bridle-bit maker: of an invention of bridle-bits, snaffles, and bradoons, for horses and other cattle, upon an entire new construction. Cl. R., 26 Geo. 3, p. 28, No. 12. August 25, 26 Geo. 3; Sept. 16, 1786.

Henry Clay, of Birmingham (Warwick), japanner: of a new method of manufacturing buttons of dyed materials not before used for that purpose, which will be much more useful and ornamental than any now in use. Cl. R., 26 Geo. 3, p. 20, No. 3. Nov. 9, 27 Geo. 3; Nov. 30, 1786.

Valentine Gottleib, of Aldgate, hair-dresser: of a crane upon an entire new construction, in which, by increasing the power, labour is diminished, and that which will perform its operations in a much more expeditious and less dangerous manner than any hitherto used. Cl. R., 27 Geo. 3, p. 1, No. 19. Dec. 19, 27 Geo. 3; Jan. 17, 1787.

John Donaldson, of Edinburgh, esq.: of a certain method of making luminators, or

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a new kind of lights, being an improvement on all sorts of candles, except dipped tallow, and is also an improvement in flambeaux, and on candle moulds, sockets, stands, and other appurtenances necessary for the making and using of luminators, by which a greater degree of light will be given, with less smoke than [by] those candles and flambeaux now in use; they will be more ornamental and elegant, and will likewise increase the revenue. Cl. R., 27 Geo. 3, p. 1, No. 4. Feb. 1, 27 Geo. 3; Feb. 23, 1787.

Benjamin Hearne, of Penryn, merchant: of a new invented method of regulating the sails or vanes of engines and mills worked by force of wind. Cl. R., 27 Geo. 3, p. 1, No. 3. Feb. 1, 27 Geo. 3; Feb. 9, 27 Geo. 3, 1787.

James Tate, of Mill-street, Hanover-square, ironmonger: of a fire-grate and utensils for cooking, boiling, and warming all sorts of fluids upon an improved principle, and whereby much fuel will be saved. Cl. R., 27 Geo. 3, p. 1, No. 2. Feb. 1, 27 Geo. 3; Feb. 26, 1787.

John Reinecke, of Chapel-street, Grosvenor-square, gent.: of a machine upon an entire new construction, called (by the specifier) "The British Boiler;" to be used in all household purposes where boiling is required, and is particularly applicable and beneficial to all trades and manufactures where boiling, washing, distilling, or evaporating, and in all mills and works where the power of steam is made use of, and upon all occasions where any liquid, sand, or substance is required to be heated, as it will be a most material and considerable saving in the article of fuel of all kinds, and will perform its several operations in a most expeditious manner than by the modes hitherto practised. Cl. R., 27 Geo. 3, p. 1, No. 1. Feb. 3, 27 Geo. 3; March 2, 1787.

Wardhaugh Thompson, of Clipstone-street, Marylebone, Middlesex, gent.: of a perfect and complete machine or instrument, upon an entire new construction, for the more easy and expeditious tuning of harpsichords, piano-fortes, spinnets, organs, guitars, and various musical instruments. Cl. R., 27 Geo. 3, p. 2, No 15. Jan. 15, instant; Jan. 31, 1787.

Robert Ansell, of Vauxhall-walk, Surry, carver and gilder: of an entire new method of preparing and mixing all sorts of colours for painting, which will obviate all the disagreeable consequences and inconveniences which are produced by the modes hitherto practised. Cl. R., 27 Geo. 3, p. 3, No. 10. March 28, 27 Geo. 3; April 19, 1787.

John Landreth, of Tabernacle-walk, Old-street, Middlesex, musical instrument maker: of an entire new improvement upon the several musical instruments called the piano-forte, harpsichord, organ, and guitar, and upon various other musical instruments, by which the same can be more easily kept in order and played upon, and by which the same will become perfect and complete instruments of their kind, which hath never before been discovered. Cl. R., 27 Geo. 3, p. 3, No. 9. March 31, last past; April 28, 1787.

John Smeaton, of Gray's-inn, Middlesex, civil engineer: of a machine on a new construction, to be used in the extracting of oil from seeds, and by which that operation may be performed in a more beneficial manner than hitherto practised. Cl. R., 27 Geo. 3; p. 3, No. 8. April 4, 27 Geo. 3; May 2, 1787.

Henry Nock, of Ludgate-street, London, gun-maker: of a new invented breeching, applicable to all kinds of guns and other firearms, whereby the powder is fired off in the centre, and much quicker, and the charge thrown considerably stronger, and the guns and other firearms will continue to fire much longer without cleaning than by any other method heretofore constructed or used. Cl. R., 27 Geo. 3, p. 4, No. 21. April 25, 27 Geo. 3; May 23, 27 Geo. 3, 1787.

Watkin George, of Preston, Somerset, millwright: of a method of destroying friction in all wheel carriages, capstans, and windlasses, and all axes of all kind of water-mills and windmills, either horizontal, perpendicular, or oblique. Cl. R., 27 Geo. 3, p. 4, No. 14. May 12, 27 Geo. 3; May 22, 1787.

Thomas Todd, of Fleet-street, organ-builder: of a machine for the washing and ironing of linen, woollen and cotton stuffs, silks, carpets, and every other woven or knit fabric. Cl. R., 27 Geo. 3, p. 4, No. 11. May 19, 27 Geo. 3; June 16, 1787.

(*To be continued.*)

LIST OF ENGLISH PATENTS GRANTED FROM MAY 29 TO JUNE 3, 1847.

Richard Archibald Brooman, of the Patent Office, 166, Fleet-street, patent agent, for certain improvements in the processes and machinery employed in scouring and bleaching. (Being a communication.) May 29; six months.

Alfred Stevens, of 2, Queen's-terrace, St. John's Wood, Middlesex, chemist, for a new or improved preparation or preparations of certain substances for making various glutinous compounds. May 29; six months.

Francis Bernard Bekaert, of Rue Royale, Exterieure Brussels, Belgium, for a method of increasing the quantity of cream procured from milk, and preserving milk. May 29; six months.

John Hill, of Hulme, near Manchester, machine-maker, for improvements in looms, for weaving certain kinds of cloth. June 3; six months.

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Christopher Nickels, of York-road, Surrey, gentleman, for improvements in the manufacture of woven fabrics, and in giving elasticity to certain articles or fabrics. June 3; six months.

Benjamin Edward Berger, of Abchurch-lane, London, merchant, for certain improvements in the construction of railway carriages. June 3; six months.

Thomas Woodbridge, of 10, Osborne-street, Whitechapel, Middlesex, corn-dealer, for a certain improvement, or certain improvements in steam-engines. June 3; six months.

Josiah George Jennings, of Great Charlotte-street, Blackfriars-road, Surrey, plumber and builder, for improvements in water-closets, and in making joints and connections of pipes. June 3; six months.

George Taylor, of Holbeck, near Leeds, mechanic, for improvements in the construction of engines and carriages, to be used on railways. June 3; six months.

William Horne, of Long Acre, Middlesex, coachmaker, George Beadon, of Battersea-fields, Surrey, commander, Royal Navy, and Andrew Smith, of Millwall, Middlesex, engineer, for improvements in wheel carriages. June 3; six months.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
May 25	1077	William Waterhouse Cutts	Sheffield, York	Guard or police signal lamp, or lantern.
,,	1078	Winsor and Newton	38, Rathbone-place, artists' colourmen	Tray or case for holding chalks and crayons.
,,	1079	Alexander Weston	Liverpool, Lancashire	Air churn.
,,	1080	Thomas Howarth	Stoney Holme, Burnley	Improved temple.
26	1081	John James	44, John-street, Oxford-street, trunk-maker	Travellers' boudoir or dressing-case, escritoire, drawers, &c., combined.
28	1082	Charles Rowley	Birmingham	Cigar tender and lighter.
,,	1083	Joseph Gardner Stutterd	Banbury	Improved mangle.
29	1084	William Graham	9, Bride-lane, Fleet-street	Cover of an inkstand.
June 1	1085	Samuel Smith	25, London-road, Derby, lamp-maker	Carriage-roof lamp.
2	1086	Barritt and Co	173, Fleet-street	Pencil case.
3	1087	Samuel Messenger	Birmingham	Tricoloured policemans' signal lamp.
,,	1088	Charles Rickets	5, Agar-street, West Strand.	Despatch gas cooking apparatus.

Advertisements.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

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The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

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E. GRANVILLE, Manager.

London, May 17, 1847.

The Claussen Loom.

APPLICATIONS for Licenses to be made to Messrs. T. Burnell and Co., 1, Great Winchester-street, London.

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25, ALDERMANBURY.

INVENTORS and Manufacturers of the Patent Self-Acting VENTILATOR, beg to call the attention of the Public generally to the following testimonial to the utility of their Ventilator as noticed in the *Mechanics' Magazine.*

George Yard, Aldermanbury,
April 24, 1847.

Gentlemen,—We are happy to bear testimony to the utility of your Patent Self-Acting Ventilator, fixed in our stables, which has exceeded our expectations, We strongly recommend it on all occasions where regularity of temperature and a free circulation of air are necessary.

We are, Gentlemen, yours respectfully,
pro M. Stanbury and Co.,
JAMES WILDER.

To Messrs. Oatley and Son,
Aldermanbury.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W.C. Campbell and Co., Hamburgh.

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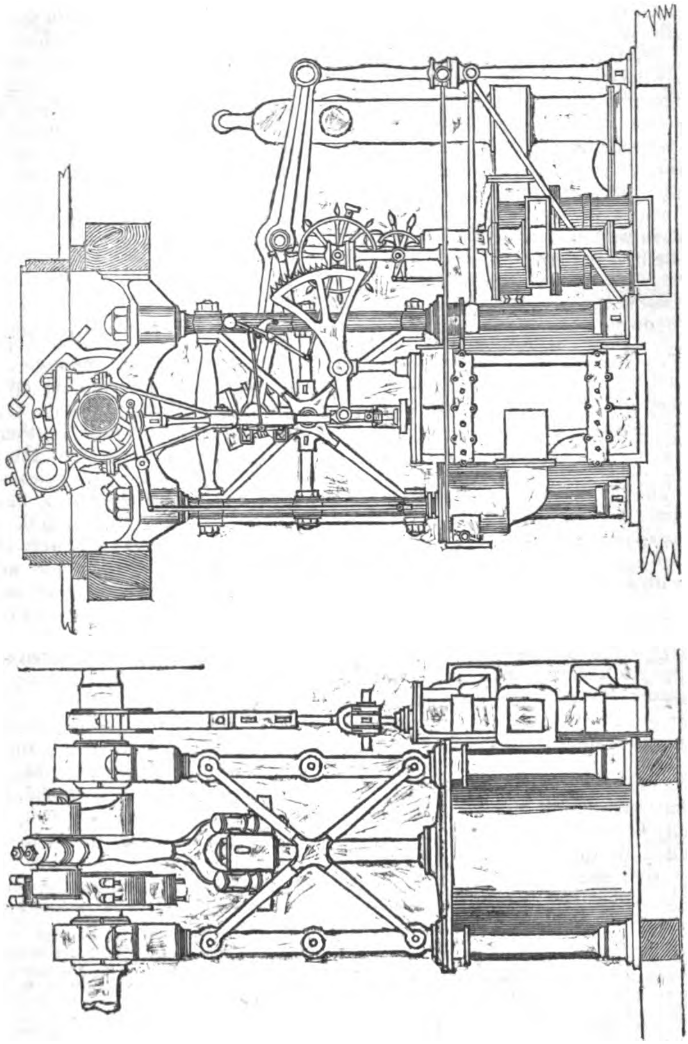
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1244.] SATURDAY, JUNE 12. [Price 3*d*.

Edited by J. C. Robertson, 166, Fleet-street.



THE ENGINES OF H.M.S.F. "FURY."

DESIGNED BY JOHN RIGBY, ESQ.

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THE ENGINES OF HER MAJESTY'S STEAM FRIGATE "FURY," DESIGNED BY JOHN RIGBY, ESQ., OF HAWARDEN, FLINTSHIRE.

The engravings on our front page represent the engines lately fitted to the steam frigate *Fury*. They were designed by Mr. Rigby, of Hawarden, and constructed under his superintendence. They are on the direct action principle, and of the collective power of 538 horses; diameter of cylinders, eighty-four inches; length of stroke, sixty-nine inches. The chief novelty in them consists in nearly the whole of the parts being made of wrought iron, copper, and brass. The consequent reduction in weight of material is such, that, though of 538 horses power, they occupy no more space than engines of 300 horses power made in the ordinary way, and do not exceed them in weight.

The first trial trip was from Liverpool to Sheerness, and, notwithstanding the vessel had to encounter a very heavy sea, not the slightest appearance of tremor in the wrought-iron main framing, or slip of the disconnecting cranks, was perceptible.

The name of Mr. Rigby, as a marine engine designer, is new to the engineering world; but the trial which the Lords of the Admiralty have given to his plans, does no discredit to their judgment and discrimination. The *Fury's* engines have a very nice and compact appearance. The cost must necessarily greatly exceed that of other engines; but cost in a man-of-war steamer, is a matter of minor consideration, compared with saving of room and weight.

ON THE OSCILLATION OF LOCOMOTIVE ENGINES, AND PROPOSED REMEDY.

Sir,—So great a destruction of human life has been occasioned by engines running off the line, that the public safety imperatively demands a government investigation of the cause. For, accidents of this nature by no means decrease, as they should do, with the general improvements in railway travelling; it being a remarkable fact, that the recent fatal occurrence on the South Coast Railway, was with an "engine of Stephenson's last patent, on rails perfectly level, and a straight line; when, at a speed not exceeding 30 miles an hour, the engine suddenly left the line without any apparent cause, the rails and the engine being in the best working order." It would, therefore, be difficult to find more favourable conditions for a well-conducted inquiry into the cause of so singular an occurrence—the fault apparently of the engine, and not of the state or obstruction of the rails; and I have no doubt that some novel facts would be elicited, not only of much scientific interest, but of great practical utility.*

It seems to me, however, that the reason of engines running off the line, where no other sufficient causes are adduced, will be found in their oscillation, arising entirely from the irregular manner in which the axles are acted upon by the cranks, which, being set at different angles, do not pull together, but alternately. The power, therefore, is not transmitted with that uniformity which is so important for all mechanical arrangements, particularly for high velocities. Even at slow speeds, most travellers have noticed that when the horses in a stage-coach gallop, it rocks, increasing with the speed; and this is caused by the horses not pulling together, but by rapid jerks, (like the cranks of the engine), thus producing that irregular motion which sways the coach from side to side, and ultimately upsets it, if allowed to continue. The same occurs to a boat,

* According to a statement in the *Railway Record* of Saturday last, this accident was less owing to any fault in the engine than to gross misconduct on the part of the Superintendent of the locomotive department of the Brighton Line. "The engine to which the accident occurred was No. 40. She was sent into the shed for a thorough repair about three weeks ago; but the line being deficient in engine power, and this solely through the proceedings of Mr. Kirtley, she was brought out again; and then it was found that the leading wheels were in so bad a state that it was necessary to send her in once more. The deficiency of power, of course, still continuing, there was not time to repair the wheels. Mr. Kirtley *ordered that the defective wheels which had been taken off should be replaced; and in this condition, on the day of the accident, the engine went to work.* Mr. Kirtley ordered Johnson, one of the old enginemen, to drive. The man remonstrated, but in vain; and, at last, he refused to risk his life on an engine in such a state. *He was discharged on the spot, and a man was sent out who never before had had charge of an engine!* The result showed that he paid dearly for his promotion.'—Ed. M. M.

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if the rowers do not pull together, producing, also, in both, that devious propulsion from side to side so analogous to a railway engine. Here are two familiar instances of oscillation, arising from an irregular transmission of power. If, then, these effects are produced by a much slighter irregularity of power, applied, too, much nearer to the centre, the tendency to oscillation, and to a devious course, is much greater in engines where the power is both more irregularly transmitted and more at the extremity of the axles, because of the greater leverage of oscillation—those engines being found to oscillate the most whose cranks are the farthest from each other. It was with such an engine, having outside cylinders, that the late accident occurred.

I propose, therefore, entirely to remove this tendency to oscillation, by setting the present outside cranks at the same angle, and by having a third cylinder, of the united area of the two outer ones, placed between them, the crank of which should be set in the centre of the axle, at the usual angles with the cranks of the two cylinders. The third cylinder I would place vertically, connecting it with the crank immediately below it by slings working in guides, in the usual way. Another improvement will also be secured by this arrangement:—the axle will not be strained or twisted, the whole power being transmitted regularly and at once; for I have little doubt that many axles have been injured and broken by the rapid jerks at each end; by the present divided and irregular application of power,—the force of 40 horses acting first at one extremity of the axle, and then at the other. This constant and violent action, many times a second, must also tend seriously to injure the bearings, and occasion much friction, and, consequently, incessant wear and tear.

Whether the cause I have assigned for engines running off the line be the true one or not, an earnest and scientific investigation is not the less needed; and this is the peculiar duty of government, being beyond the power or information of the public. But, unfortunately, there is so much remissness on the part of government in all that concerns the public health and safety, that, unless the press also compel inquiry into the latter, as it has at last enforced it in the former, nothing will be done. No stronger reason for its necessity can be found, and no more serious reproof for culpable and fatal neglect, than the following evidence, given on the late South Coast Railway inquest, whose proceedings, fortunately, have not yet terminated:

"CORONER.—Then, how do you account for the accident?"

MR. KIRTLEY.—"Accidents *of a similar* character have happened on other lines. Engines have left the lines of the Eastern Counties, Royston, Torrington, and the York and Newcastle."

FOREMAN.—"But they were accounted for?"

"No!"

Is not this culpable neglect of government? We have it in evidence, that accidents *of the same kind* have been of frequent occurrence, on *different* lines, without giving rise to the slightest investigation of the cause, for their prevention! They are still unaccounted for! And now another *similar and fatal* accident has occurred on a most perfect piece of railway; and, though Mr. Kirtley surmises that this was occasioned by the outside cylinders causing the engine to oscillate, there is nothing to show that the accidents on the other lines were not from engines of the more common construction,—most probably the case, inasmuch as the engine in question was "one of Stephenson's *last* patent."

The reflections upon this culpable neglect of government are very saddening. Human beings have been suddenly sent to their last account, who might still have been among us; and the shattered and suffering survivors might still be in the enjoyment of their severed members and their health. Nor should delay take place in the proposed inquiry; for, assuming that the cause I have suggested to be the true one, and that *all* locomotives of the present defective transmission of power possess, more or less, an inherent tendency to oscillation, the public will still be constantly liable to the same fatal and mutilating accidents, from the slightest obstruction, even on the best lines of the kingdom, until the engines are altered. Nothing must be left to the care of the driver that human ingenuity can transfer to the machine. We must have engines of so much power and velocity, and having at their control the

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lives of so many human beings, as perfect and as safe as science can ensure, since their effects are so tremendous and fearful when they go wrong.

I am, Sir, yours, &c.,

J. H.

City Club, June 7, 1847.

P.S. My plan for ventilation—which I proposed about this time last year, in your useful Magazine (No. 1190)—has been adopted with great success at the Consumption Hospital, Brompton.

THE "COLLEGE OF PRECEPTORS."

(Continued from page 490.)

We have designedly given a fortnight's truce to the "College of Preceptors;" as we considered it but fair to allow the council, or any of the members of the college, adequate time for the preparation of any statement or explanation which it may be in their power to offer. The only attempt that has been made to reply to our strictures, is in a letter from Mr. Wharton, which we print entire. We are more inclined to print this letter from its containing a defence of himself personally, than from any other motive—since it does not in the slightest degree neutralize the censures which we have felt it our duty to direct against the tactics and principles of the founders of this college generally:

Sir,—In your article of the 22nd of May, on the "College of Preceptors," you express yourself desirous of certain chronological information in reference to its origin and formation. First, however, allow me to correct the error you have made in that number in imputing to me the objectionable sentence, "*That incompetent and unworthy pretenders not daring to offer themselves as members of such an association will sink into their proper insignificance.*" I can safely say there is no such statement in any writings of mine. I beg to thank you for the manner in which you have completely elucidated my remarks on the Woolwich Academy in your number of the 29th, and further to remind you, that Woolwich is not alone in its claim to the honours of public reprobation.

In the spring of 1845, the subject of a College of Schoolmasters was canvassed in Brighton, and the matter was publicly brought forward in a lecture by Mr. Parker, in October 1845. Eight years previously a public lecture had been given on the same subject in Brighton. Gentlemen in Worcestershire, Staffordshire, Middlesex, and even in the Isle of Man, had for some years, unknown to each other, been advocating the same plans. A Scholastic Journal in London had in January 1845, advocated such an institution. When, therefore, in January 1846, after the formation of a committee, the plan was publicly announced, it quickly met with many abettors, and was actually established by the formation of a national committee in March, 1846. The formation and adoption of such a scheme ought not therefore to be attributed to any formation or emulation of a subscription school or college of which the first announcement was in Jan. 1846. "The "College of Preceptors" has arisen from the wants and requirements of the age, and however much you may be tempted to indulge in a little satire, I have no doubt that it will eventually obtain, as it ought to obtain, the support of all men who possess either humanity or education. Even the steps you censure were taken with the purpose of preventing injury to many industrious teachers of the old school; and with a full conviction that the integrity of purpose of the members of the "College of Preceptors" will weather out all attacks,

I am, Sir, yours very truly,

J. WHARTON.

Brighton, May 31, 1847.

As regards our imputing to Mr. Wharton the passage in question, we can only say that we copied it from a printed sheet *sent us by Mr. Wharton himself, with a short note to ourselves at the head of it, in his handwriting*, and dated Brighton, Feb. 23, 1847. The letter occupies two pages of the sheet; the Council of the college the third page; and the "objects," "plan of operations," and "further results contemplated," the fourth. It is the more remarkable that Mr. Wharton should disown the "objectionable sentence," whilst as an addendum to his separate note, he writes "Observe the society"—meaning, as we presumed, the statements of its Council and objects. We give him full credit for not writing it, since he repudiates the principle; but if he objected to it, why did he allow it to be appended to his own letter as an ostensible postscript written by himself? Why did he give *personally* his own means of circulation of such a principle? We see little difference between the adoption and the authorship of such doctrines. He had a right to insist that no matter which he did not himself approve, should be appended to a letter for which he must inevitably take all the credit or the blame that might accrue; and in case of the Council resolving to act towards him with such manifest injustice, his own sense of self-respect should have led him to withdraw either his letter or his name from the society. We should have withdrawn both: and Mr. Whar-

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ton knows that he would have a good precedent for doing so—of which more presently. At all events, *we* cannot be blamed for attributing, under these circumstances, the principle in question to Mr. Wharton as its author; and we have afforded him the opportunity of repudiating it. We should be glad to know from whom it emanated. From that very bustling, and withal that *very literate* person, the Secretary?

Mr. Wharton is, however, quite mistaken if he thinks our comments are founded on the temptation "to indulge in a little satire." Had the tendencies of the "College" been merely ridiculous, without being (as in our estimation they are) also mischievous, we should have left their vagaries to be dealt with by abler satirists than ourselves. But we cannot allow a system which, to our apprehension, is pregnant with great social evil, to gather strength without calling public attention to the scheme, in the most earnest manner we are able. Mr. Wharton, whilst he lays claim to sincerity and patriotism *in his devotion* to the cause he has espoused, ought to give those who dissent from him credit for the same motives of action. Those, however, who are in the habit of claiming credit for their own motives, are often the least disposed to allow it to their opponents; and certainly Mr. Wharton's is no exception to this "failing case" of partisan-ethics.

As regards the question of *priority* of the "College of Preceptors" and the Brighton Proprietary College, it is of little moment. We had, indeed, casually remarked (p. 446), that the latter was the parent of the former; and this may entitle Mr. Wharton to the reply above. We beg, however, to remind him, that the actual "institution" of the two colleges is a different thing from the "canvassing;" and we have very good reason for believing (in fact, we *know* it) that the Proprietary College was considerably anterior to the other in respect to its canvass; and, moreover, that it was a distinct understanding amongst the schoolmasters that their college was necessary as a *defensive measure*. We have taken no exception to this step, and we will not allow the main question to be turned upon such a triviality. Of the lecture to which Mr. Wharton refers, as given at Brighton in 1837, we know nothing; but the pamphlet which he published in 1839 would, we should suppose, embody the same views as the lecture. We have looked in vain for any scheme in that pamphlet having the slightest *essential analogy* to that of the embodied "College of Preceptors." We will, however, neither waste our own nor our readers' time upon such frivolous inquiries, knowing, as we do, that, for half a century at least, the necessity of some criterion of the fitness of a schoolmaster for his duties has been very generally acknowledged. It was no modern discovery in 1837; and it is sheer trifling for the "College of Preceptors" to pique themselves upon such points as these.

We have already, we trust effectively, explained the *composition* of this college, the dogmatism of its council, the galling yoke it contemplates laying on the schoolmasters of England, and the arrogance with which it lays down its dicta on all subjects connected with the economy of education. To no one of the charges under these heads has the least attempt been made either for refutation or explanation, although we have plainly stated that our pages are open to this purpose if the "College" deem it prudent to use them. The fact is, that Mr. Wharton is too straight forward a man to be altogether an agreeable associate to the President, Secretary, and Company. The Council are "laughing in their sleeves" at the circumstance of our being supposed to have singled him out as the "scapegoat" of the college. They look to getting *him* out of the management, and escaping all censure themselves. They are mistaken: we are partisans neither of Mr. Wharton nor of Messrs. Turrell and Parker. We are partisans of truth, of right, of honour—not of men, nor yet of measures, further than as they conduce to the well-being of society.

The first great step towards elevating the schoolmaster is, *to elevate his scholarship and his powers of mind.* We see in the Brighton scheme no tendency towards this—no measures contemplated for raising the acquirements of the class above the present *mediocre* level,—no provision for insuring it in future. Sufficient clamour is, indeed, raised against the privileges which the πολλοι of Cambridge enjoy; but are we to understand the gentlemen who compose the "Col-

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lege" to affirm that their own scholarship is of a higher order? We suppose they hardly do; for one of their rules is, that graduates of either university shall be admissible as members, without examination, by the college board! All the elevation which these men covet, is a *social elevation*, irrespective of their literary, scientific, and professional merits. Had they, as we were at first led to believe was their intention, formed a society of a single hundred, or even of fifty schoolmasters, whose reputation as men of letters and men of science was established, and who had been successful in turning out fair scholars from the schools over which they presided—then, indeed, we should have had confidence in the success of the movement; for we should have felt confidence in the directness of its purposes and the wisdom of its measures. The object pursued by the founders of this college, looks very much like an attempt, by agitation, clamour, influence, and commercial desperation, to raise the lowest of the most illiterate portion of the schoolmaster-class to a level, in public estimation, with the highest order of the most cultivated minds that are engaged in preceptorial duties! Let them, at the same time, raise the intellectual character and acquirements of these men to the same high station, and we will, with all our souls, bid them "good speed!" But, on the contrary, for the sake of a few paltry guineas with which to "work the concern," *they have forfeited all claim to public confidence, by stamping, as qualified teachers, every one who thinks his guinea well spent in the speculation!* Are these, then, the men upon whom the public, the parliament, or the crown will confer the powers of dictatorship in education? They might be; and they will be, if not checked in time. It is too late for them now to retrace their steps, or retract their published intentions, though we have good reason for believing that the few men of talent amongst its members are not only dissatisfied with the shape in which its principles have been developed, but ashamed of the absurd manifestoes which their more braggart colleagues have put forth in speech and in print. For these we conceive there is open but one honourable course—withdrawal; as we do not imagine the possibility of a few temperate and respectable men exercising any beneficial influence over the more desperate leaders of the opposite class, supported, as these latter will always be, by the ignorant mass of the general members. If *these* withdraw, the "College" must sink for want of creditable talent; if they do not, they will be lending themselves, willingly and knowingly, as co-operators in imposing a gross delusion upon a too confiding public.

The Council is, indeed, fully alive to the value of *names*, and it strains every nerve, and descends to manœuvres not very creditable for getting and retaining them. It is scarcely worth our while to enter much into this subject; but we consider that we ought to give insertion to one fact, for which we are indebted to one of our earliest and most valued correspondents. He writes:

"A near relative of mine, the Rev. Dr. Butler, in order to help the college onwards in its earlier struggles (and giving its founders credit for the high degree of scholarship they professed to have), gave his name and his guinea as a member. Dissatisfied, like myself, with the absurd and unscholarlike 'test'* which the council issued in April

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* That it may be rendered evident that our correspondent had good grounds for declining to co-operate with this society, and his friend for withdrawing, we give the paper to which he, obviously, refers:

"SOCIETY OF SCHOOLMASTERS.

"ADDENDA—*Committee, April, 4th*, 1846,

"PROP. 18. — That the examination, the First or Commercial Qualification be limited to Hind's Arithmetic, Mensuration, Book-keeping, Penmanship, Geography, English History, and English Composition.

"That the First Classical Test be limited to Arnold's Latin Composition—Cæsar de Bello Gallico—Virgil's Æneid, first 6 books—Keightley's Roman History.

"That the Second Test of Classical Qualification be limited to Arnold's Latin Composition—Arnold's Greek Composition—the Odes of Horace—the 21st and 22nd Books of Livy—one of Porson's Greek Plays—one Book of Herodotus, or Thucydides—with any other Authors the Candidate may choose to bring up.

"That the First Mathematical Examination be limited to General Arithmetic—the first four and the sixth Book of Euclid—Trigonometrical Mensuration of Heights and Distances—Algebra, to the Binomial Theorem, and Bland's Algebraical Problems.

"That the Second Mathematical Test be the Differential and Integral Calculus—Statics—Dynamics—Analytical Trigonometry, with the lower or previous subjects.

"PROP. 9.—*The Examining Body.*—The Examining Body shall be composed of gentlemen who have taken an honorary degree at one of the Universities. They may be chosen from members of the Society; or, by Special Invitation, from Cambridge or Oxford. The Board shall consist of not less than three Examiners, who shall be paid for their services and be attended by a Secretary.

"Teachers of Foreign Languages, whether Eng-

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of last year, ***he at once withdrew, giving to Mr. Parker, the secretary, due instructions to that effect;*** and I, who was too little informed on many particulars to decide upon giving my name and my money to the scheme, at the same time declined all further correspondence on the subject, for the same reason that my relative did. You will judge what my surprise must be when I saw, in the 'Calendar,' the name of Dr. Butler still retained both in the 'provisional committee,' and in the 'alphabetical list of its *present* members.' Every step which the Council has taken subsequently to the isue of that '*test*,' is in a direction that would not coincide with his views; and yet, for the contemptible purpose of parading as many university names, and especially clerical ones, this outrage on common decency and common honesty is perpetrated. It appears to be as difficult for a man of influence and character to get out of the 'College of Preceptors,' as for a man of wealth and station to get out of the provisional committee of an abortive railway scheme."

We need not ourselves add one word to the pointed rebuke of our correspondent; and we do not know the language in which the *meanness* of such an act can be adequately condemned. It should be a warning to every one who is solicited to take part in schemes concocted for purposes which are not so clearly defined as to be incapable of abuse; and schemes, too, which are worked by men in whom we cannot feel every confidence that their professed object is their real one. We suppose now, however, the Doctor will stand a chance of getting his name removed from the list; if it be not removed, we beg to hear from our correspondent again.

We again question the correctness of the professed *motives* of the "Society of Schoolmasters" as indicative of the *present purposes* of the *managing clique* of the "College of Preceptors." From beginning to end we can view it as no other than selfish and mercenary. The social elevation of the schoolmaster must be the result of his intellectual elevation; for on no other ground has he the least claim to a higher position than he now occupies in the social scale. The "College," for the sake of the guineas, has chosen to decide otherwise; and there are hundreds (even the great mass of its present members) who can speak to the pressing style in which Mr. Parker called for the "guinea"—even amounting to gross offensiveness. That lynx-eyed gentleman never failed to ring the changes on the "guinea," nor allow his pen to omit a full reference to the "post-office order." But was there no prospect of personal advantage mixed up with this laborious devotion to the duties of "*Honorary* Secretary"? It is true, at any rate, that a section of the public was favourably impressed with a belief of Mr. Parker's own superiority, from the constant parade of his name as the *unpaid* secretary of a society which professed to weed the scholastic body of its "incompetent pretenders." But his prospects have taken a more definite form; and he is now, having given up his school at Brighton (not sold it, for who would buy it?) appointed "General Secretary and Treasurer at an adequate salary." It is therefore his *interest* to fill the list with as many names, and the "College-chest" with as many guineas, as he can persuade people to give him; and this altogether irrespective of the professional status, or literary qualifications of the several contributors. He works the business well, *as a business of his own:* how far it is well-worked for the public benefit, time alone can tell—but we need not say that *we* augur unfavourably.

We do not so say without authority, and will give one or two specimens of Mr. Parker's management. The following advertisement appeared in the *Times* of the 12th ult.; and it will, no doubt, "catch a whole shoal of gudgeons;"

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lishmen or otherwise, shall be examined by Native Professors well known to the Public by their connection with Colleges or Public Schools.

"A General Meeting of the Profession, on or about the 18th of June next, of which due notice will be given by public advertisement, is contemplated. Gentlemen disposed to co-operate are invited to forward their names to the Secretary: as are also Assistant-Masters desirous of being enrolled at Midsummer."

[We wonder, after such a publication as this by the Council, that any man of the least respectability or pretension as a scholar, could have consented to join that body. Such a "cart-before-the-horse" jumblement of subjects, it has rarely been our lot to witness—never, indeed, but in the "Syllabus" of the gallant colonel who figured in our pages a littlewhile ago, as "the only proper person to superintend education." To use the language of our valued correspondent "A. H.," it is a fine illustration of what Jonathan would "guess to be a pretty considerable tarnation lot of jargon." The mathematical part of this *rigmarole* was put together by one of the members of the present "Mathematical Board of Examiners"! It was subsequently announced, that the "test" would be the SENATE HOUSE PAPERS! Of the present test we shall speak hereafter. ED. M. M.]

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"COLLEGE OF PRECEPTORS.—The Secretary to the "College of Preceptors" *has numerous applications from the principals of first-rate schools for assistant-masters who have received the certificate of the College;* he therefore begs to announce to those gentlemen who may be desirous of obtaining such certificates, that the EXAMINATIONS will be held at the St. Peter's Collegiate Schools, Eaton-square, and will commence on Tuesday, the 22nd of June next. Full particulars of the last examination, together with the rules and other information relative to the proceedings of the College, will be found in the Calendar of the Institution, which is now being issued by Messrs. Longman, price 2s. 6d.

"JOHN PARKER, Sec.

"Office, 42, Great Russell-street."

Can any poor usher, however limited his means, resist such an enticing appeal to his future interests, and the prospect of a "good situation," by paying his guinea and "taking his chance in the examination." If he get his "diploma," his fortune may be made! He must, however, pay his guinea *before* he can be examined; and Mr. Parker has the benefit of the money, whether the candidate be allowed his degree or not. Looking, however, at the questions "set" in the January paper, and hearing what we have heard of the leniency of the council in the matter of qualification, we do not suppose that many of them need fear much for the result. All who "go in," will "come out" with their certificates. We believe, indeed, that a kind of pledge has been given by the most active members of the college to one another, *that they will not employ any assistant masters who have not passed the college examination.* Are we correct in this? If so, the examinations must in time become more rigid; and the interests of the rest of the body will materially clash with those of Mr. Parker. This gentleman, at any rate, is displayed to great advantage, by his advertisement, as "a capital man of business."

Again: in a subsequent advertisement in the same paper, a bait is cleverly thrown out for the schoolmasters and the public. A list of subjects, and of examiners, is given, amongst which we find "*Hebrew and the Septuagint*," and the "*Anglo-Saxon and Comparative Philology!*" We shall really expect to next see Chinese, Russian, Sanscrit, the "Ojibbeway classics," and the "polite literature" of our visitors, the Bosjesmen, included in the College programme!

In the same advertisement is given "the higher mathematical test" to which they have *now* arrived. It is composed of "Plane and Spherical Trigonometry, Conic Sections (geometrically), Statics and Dynamics, Dr. Wood's Optics, Differential and Integral Calculus, and the first three sections of Newton."

This part of the programme differs but little from the Cambridge one for the "poll-degree"—that little consisting chiefly in the substitution of the differential and integral calculus for hydrostatics and pneumatics. After all, we feel quite certain that if an examination be conducted with reference solely to securing men qualified to teach these branches of science, the "tripos-paper" of the "College of Preceptors" will cut but a sorry figure; for the men who are competent to pass a creditable examination in these subjects, will spurn such contemptible credentials of their ability as the "certificate of the College" would constitute. In fact, these conditions will never be complied with by the candidates; and the diploma given by the college will be as complete a delusion as the poll-degree is at Cambridge. We look upon the college certificate merely in the light of a purchased testimonial; a matter of pounds, shillings, and pence. The bargain is, indeed, circuitously made, so as to divest it of the legal form of a bargain; but we must have a more satisfactory guarantee for the candidate being *really qualified to teach* these several subjects, than is afforded by the past movements of this college, before we can receive its certificate as trustworthy.

We believe the Council of the College is sadly perplexed between its attempts to rough-ride the "profession" and to conciliate the universities. Towards men of academic station, they are servile and parasitical to the most odious degree; and we hear that more than one of them has been flattered into dalliance with the "*touters*" of this college—not very complimentary to the judgment of men in high places. Let these accessible gentlemen recollect (perhaps we should say, let them be informed) that, with all the smooth pretences with which they are approached, in the "public lecture of Mr. Parker, in October, 1845,

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which first gave consistency to this movement," the most bitter and querulous hostility was expressed against the privileges enjoyed by university men. The same feeling is continually oozing out in their manifestoes, and still more virulently in their freer conversation and private letters. We entertain no veneration for the trencher-cap, or even the Chancellor's robes; but we cannot look upon this covert attempt to obtain university cooperation for the purpose of destroying university authority, as otherwise than disingenuous, if not dishonest. Even supposing the educational authority which this college proposes to substitute for the authority of the universities, to be a desirable one (which we do not), the best that could be said of such a mode of proceeding is, that it would be "doing evil that good may come"—a not very appropriate maxim or creditable practice for those who *claim a right* to "the education of the middle classes" of England. These men cry out against "monopoly," and yet they seek, by every means, to establish a monopoly for themselves. It is one of the phases of human nature, which was so strikingly displayed, in a slightly different form, at the Reformation, by the Romish and Protestant persecutions.

(*To be concluded in our next.*)

THE DISINFECTING PROCESSES OF SALOMON, SIRET, ETC.

Sir,—In No. 1229 of your valuable Magazine of this year there is an article, signed "A Farmer," respecting the disinfection of feculent matter in order to transform it into manure. I take leave to enter into a few details as to the results obtained by means of the plan recommended by your correspondent of using of sulphate of iron; five or six lbs. of which, he says, suffice to disinfect twenty-five gallons of feculent matter.

In 1831, Monsieur Salomon obtained in France a patent for the manufacture of manure, which he called "*Noir animalisé.*" A company was formed in Paris to manufacture this manure: the process consisted in carbonizing the mud collected in towns, and vegetable earth, so as to reduce them into an absorbing carbonated powder, which was mixed with the feculent matter in equal parts, so as to cause disinfection. But this system cannot be made applicable to excrements or urine, nor does it ensure a permanent disinfection. Notwithstanding the patronage of Monsieur Payen, the celebrated French chemist, this company, under the management of Monsieur Buram, was obliged to liquidate its affairs, as the manure produced by the process did not give the result that agriculturists obtained from the ordinary manure called "*Poudrette.*"

In 1844, Monsieur Siret also proposed the adoption of a carbonated powder or disinfected paste; but the company which he formed existed only a few months, as the trials and experiments made proved complete failures. This powder was produced by means of sulphate of iron, sulphate of lime, charcoal, or burnt earth, and a little water.

Monsieur Schattmann, of Bouxvillers, wrote a letter in the course of the same year to Monsieur Dumas, of the Academie des Sciences, drawing his attention to the effects which he had obtained by using sulphate of iron; but an experiment tried at the Observatoire at Paris, in the presence of Monsieur Arago, showed that his plan was insufficient and inapplicable. Moreover, this scheme was not a new one, for sulphate of iron had already been proposed to the Academy of Dijon, as an antiseptic, as far back as the year 1767.

I think, Sir, that these observations must convince your readers of the fallacy of these systems. The proof is in the failure of the schemes. Besides they were exceedingly inconvenient and costly, as the feculent matter to be rendered available, was vastly increased in bulk by the addition of other bodies, and what was worse, the disinfection was neither instantaneous nor permanent.

Sir, your most obedient servant,

CHARLES F. ELLERMAN.

21, Pelham-place, Brompton,
June, 1847.

PERCOLATING GALVANIC BATTERIES.

Sir,—I have just seen in the last number of your Magazine, a notice of a trial in the Vice-Chancellor's Court, Brett and Little *v.* The Electric Telegraph Company and Charles Massi, for infringement of an invention of certain "improvements in the Voltaic Battery,"

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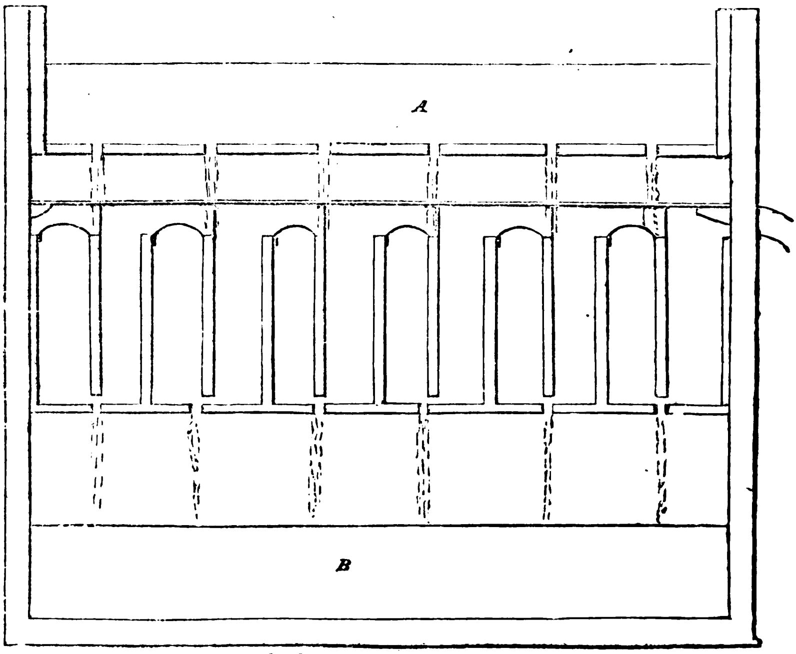
patented by Messrs. Brett and Little in February, 1847. Now I have had a percolating battery in operation four years ago, and found it to answer all the ends for which it was invented.

The battery was constructed in separate copper cells, nearly the same as Mr. Barker's, mentioned in the *Annals of Electricity*, vol. i., but with each cell perfect in itself, and without the piece of wood. The cells were all connected with one another, by a copper wire being soldered to the edge. The zinc plates were also all connected together by a copper rod, which rested on two brackets in the frame of the battery; the plates were connected with the cell by a short cleft copper wire, which was soldered to the zinc plates, being passed over the edge of each of the cells, the ends of the connecting wires or rods forming the voltaic circuit. Each of the cells was perforated with a small hole at the bottom, and a plug of wood was inserted so as to allow the solution of sulphate of zinc and copper to slowly trickle through as it was formed. The cells rested on a bar of wood over the trough containing the sulphate of zinc solution, and over the battery was a trough containing the acid solution, with a similar number of holes in it to allow the solution to escape into the cells so as to keep the battery always of the same strength—having in fact much the same arrangement as Messrs. Brett and Little's, except in so far as the cells were of copper, and flat instead of conical at the bottom.

I therefore claim the invention as mine, and shall be able to produce evidence of its being in use at the time stated if required. I should have sent you one of the cells, but having left the battery in Dundee, I cannot at present do so.



I send you a sketch of the battery, which will be readily understood. A is the vessel for containing the acid solution; B the receiver of the sulphate of zinc solution: the wood plugs and the copper rod connecting the cells have been left out.

By giving this a place in your valuable Magazine, you will much oblige

Your most obedient,

ARCH. NEWALL.

Gateshead-on-Tyne, May 31, 1847.

[It would not be sufficient to invalidate

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Messrs. Brett and Little's patent right, that Mr. Newall had his battery "in use" four years before, unless it could be shown that the use was a *public* use. The point of right in all such cases turns on the point of fact, whether the public were in actual and notorious possession, at the date of the patent, of the invention which formed the subject matter of it. —Ed. M. M.]

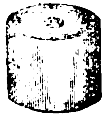
BLASTING BY POTASSIUM (INSTEAD OF VOLTAIC ELECTRICITY).

Sir,—Having lately directed a great deal of attention to the methods employed for removing sunken vessels, it occurred to me that there may be other means equally effective with, and perhaps more convenient than those which have been recently employed by Major General Pasley and others,—namely, the firing of gunpowder charges by voltaic electricity. For it may not always be convenient to employ the power of voltaic electricity, on account of the great lengths of wire required, and their liability to damage, corrosion, &c.

Potassium, it is well known, possesses the property of decomposing water when thrown into it, and so gives rise to a peculiar kind of gas,—termed potassuretted hydrogen, which takes fire in contact with the atmosphere; I propose therefore to take advantage of this peculiar property in potassium, and to apply it to the purpose of submarine explosion, in the following manner:

Let us suppose figure 1 to be a cylinder made of tin, wood, or other suitable material, closed at both ends, with

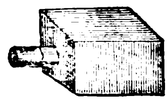
Fig. 1.



the exception of a small hole in the centre of one of the ends; let this be made water-tight, and filled with gun-cotton—for this substance will be found more convenient than gunpowder; if powder however is used, a piece of paper pricked with holes, must be pasted over the hole. The cylinder therefore being charged, take another very small cylinder, made of pasteboard, closed at one end, and made large enough for its open end to cover the hole in the large cylinder; this being ready, a piece of potassium is placed in the small one and then fastened to the large cylinder as quickly as possible, to prevent any air from getting to the metal, taking care to keep it inverted the while as in fig. 2.

Fig. 2.

Fig. 3.



A represents the large, and B the small cylinder; the small one should never be made any deeper or larger than what is required for the potassium to fit in; and great care should be taken to keep the inside of the cylinders dry. Having thus fastened the small cylinder on, and varnished all around the joinings or over any small holes, but not over the cardboard, weights may be attached to the lower part of the large cylinder, so that it may sink inverted the same as in fig. 2. The apparatus will be then ready for use. The whole is taken down in the usual way by a diver. Within half an hour the water will have soaked through the pasteboard cylinder, and as soon as it comes in contact with the potassium, the water will be decomposed, and form the gas before mentioned, with an evolution of light and heat, which will of course ignite the cotton, and explode, driving inevitably before it whatever lies in its way.

Such an apparatus could be applied with success for blasting rocks, or for carrying on operations in mines (where the wires of a battery cannot conveniently be conveyed), by merely covering the small cylinder with water. In places where the cotton cannot be obtained powder must be used, and then the best plan would be to have the cylinders, or cases, horizontal, as shown in fig. 3. The large case is represented square, to make it more convenient for use.

I am, Sir, yours respectfully,

E. B. Lloyd.

June, 1847.

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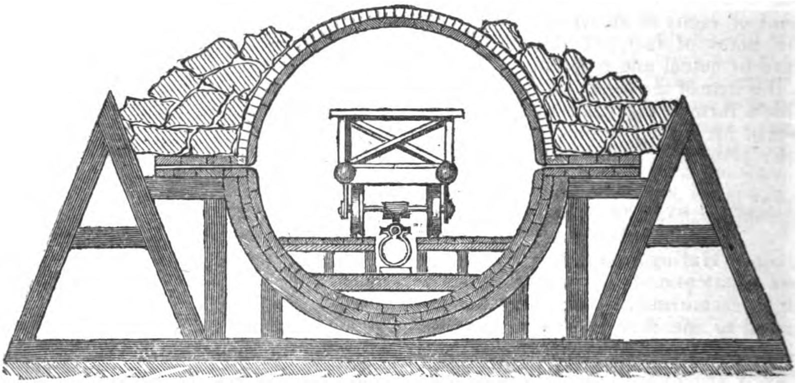
MR. DE LA HAYE'S SUBMARINE RAILWAY BETWEEN ENGLAND AND FRANCE. FURTHER DETAILS.



Respected Friend,—It is now about eighteen months since a description of my plan for constructing submarine railways appeared in the pages of the *Mechanics' Magazine*, and I then stated that I was aware the invention was susceptible of numerous modifications. Since then I have been occupied in perfecting the plan; and perhaps the following details will convince those, who may have viewed the subject in a formidable light, that the engineering difficulties are almost entirely obviated.

My first idea was to construct an iron tube sufficiently strong and rigid to bear the weight of the trains, and the pressure of the water outside, whatever might have been its shape; but subsequent examination has led me to find that this plan would be very expensive, while no material advantage would be gained. But before entering farther into the details, I will state, that the present plan is based on the now well known fact, that the soil in the English Channel is perfectly level,—that is, presenting a gradient of only one foot in 300. So that a more favourable site for a railway cannot be found; while the depth of water between Dover and Calais is only 200 feet, or about the length of an ordinary steam-vessel. It is, in fact, less than four times the width of the deck of the *Great Britain* steamer; so that far from the channel being a dark unfathomable depth, it is a vast plain, so level, that there is not, perhaps, a spot on land, of an equal extent, so favourable for laying rails. I had been long since informed by an eminent geologist, that the bed of the water in the Channel was level, as the nature of the soil prevented its being otherwise; and subsequent statements from engineers have verified this assertion. I beg to submit the following plan, as a modification of the original:

Instead of constructing the tube of the form of an ordinary railway tunnel, with iron one inch in thickness, and of a sufficient width for a double line of railway—I would propose to construct a perfectly cylindrical tube, 14 feet in diameter, with iron only one quarter of an inch thick, and furnished with a flange 3 feet wide, exactly in the centre; so that the tube would be formed of two semi-cylindrical parts bolted together on each side at the flanges. This tube would be strong and easy of construction, while it would be cheaper than if constructed on the original plan, and being formed of thin metal plates, would have very little rigidity, and consequently would not be liable to strain, on being floated, as vessels are liable to be; then the cylindrical form would enable it to sustain the weight of the water at any depth; but 100 lbs. per square inch is the utmost it would have to sustain in the centre of the Channel.

The tube being constructed as above described, I would cover it with a thin sheet of flexible waterproof substance, such as felt, or kamptulicon; and over this I would fasten oak planks of 3 inches in thickness. These planks would

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be laid longitudinally, and would entirely cover the tube, and thus protect it from injury or the action of salt water; they might be bolted to iron ribs, and connected together with marine glue. Then, to prevent the wood from wearing, I would cover the whole with small blocks of blue granite, similar to paving stones, and fastened together with hydraulic cement, so that the iron would be completely isolated from the water; it would not be essential to place stones on the under part of the tube, but only on the top, from one flange to the other.

This part of the work being in progression, I would construct a cradle sufficiently deep to admit the under part of the tube, and sufficiently wide to allow of the flanges resting on the sides. This cradle might be made of oak, and covered with a sheet of iron, one quarter of an inch thick, and similar in shape to one-half of the tube. Being placed on the bed of the water in divisions of 1000 feet in length, and left during some time to settle itself on the soil, it would form a firm foundation for the railway; so that the tube would be required merely to exclude the water, and to place the platform for laying down the rails—the weight of the trains being sustained by the cradle, and not by the cylindrical tube.

To connect the divisions, all that is required is, to construct one end of the upper part of each division, so as to project 6 feet over the other, the inside of which would be lined with a sheet of India-rubber. On lowering the division on the cradle, the end would fall on the end of the upper part of the other division, covered also with a waterproof substance; then by bolting the whole together from the inside, near the blockading frame, no water could pass between. The blockading frames could then be removed, and the divisions permanently connected with iron plates.

To protect the tube from the violence of the waves near the shore, I would propose to build two stone walls, or breakwaters, parallel to each other, leaving sufficient space between to enclose the cylindrical tube; then to place other stones from the top of the breakwaters, so as to cover the tube entirely. These breakwaters would not be much higher than the tube; so that only a small part would be exposed to the action of the waves at the same time; the sides should not be perpendicular, but constructed somewhat similar to the base of the Eddystone lighthouse. In order to protect that part of the tube placed in deep water, I would propose to throw large quantities of loose stones and rubbish over it, which would completely surround the building, and render the cradle in the lapse of time almost unnecessary to support it. The tube would thus become in effect a tunnel, completely isolated from the water, and as safe from injury as in any other situation.

In the details of the original plan, I had estimated the cost of constructing a railway from Dover to Calais at eight millions sterling; but by the above plan, the cost is considerably diminished, as only 25,000 tons of iron are required for the tube itself: and as the work would be similar to ordinary boiler work, the cost may be estimated as follows:

25,000 tons of boiler work, at £20...	£500,000
Cradle	500,000
Four Breakwaters	400,000
Woodwork, Stones, &c.	400,000
Miscellaneous Expences..........	700,000
	£2,500,000

Thus, for the sum of two millions and a half sterling, a communication may be *opened*, on *terra firma*, between Great Britain and France; so that this road would, as it were, change the geographical position of this country with the continent, without expending more than at the rate of 125,000*l.* per mile, and possibly a less sum would be sufficient; but it will be at least evident, that the sum expended on the works would be soon repaid by the immense traffic. I have not alluded to the cost of building the stations at each end of the tube, as it is probable the two Governments would take on themselves to furnish the amount required for constructing buildings on a sufficiently extensive scale to make each appear, what they would be in reality, the door of the neighbouring kingdom.

It will be admitted that this plan has nothing complicated in its details; the main part of the work is completed on land; and thus no danger whatever is incurred; consequently the practicability of carrying it out will not, I presume, be questioned by those men of science who have taken the trouble of investigating the subject. At the meeting of

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the Liverpool Polytechnic Society, after a lengthened discussion, nearly all the members spoke in favour of the practicability of carrying out the plan; and the chairman, in giving his opinion, said that it might be considered in a commercial point of view, that is, whether the sum expended on the works would be repaid by the traffic; to which all the members present assented. The above modified plan may satisfy the world on that head; as it will be evident to every one that the traffic would be greater than on any road. Yet I am aware that the novelty and magnitude of the plan may prevent many persons from pronouncing in favour of its being immediately carried out, however free from obstacles it may be proved to be; for the history of all inventions tells us that positive proofs of the advantages of adopting anything new is not sufficient for its success. Time has been always required to enable mortals to familiarize themselves with the new idea. Such was the fate of railways; during more than thirty years the world refused to accept this present which science offered, under pretence that it was "too good to be true." And when the submarine telegraph to India was first proposed, many years since, the project was considered chimerical; a host of objections were brought against the scheme, all of which seem to have died a natural death, but not so those who denounced the proposition; they have probably some wind left in them to attack some other new project. I have only to request them, that should they wish to make my invention a target to shoot at, they may do so as publicly as possible, and on scientific grounds.

I remain respectfully,

JOHN DE LA HAYE.

5th mo. 12th, 1847, London-road, Liverpool.

NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

No. 7.(a)—BIQUADRATIC EQUATIONS.

I now propose to resume the discussion, broken off at the conclusion of No. 4 of these *Notes* (b), respecting the reduction of biquadratics to the binomial form already alluded to—in which its three middle terms have vanished.

"After having seen how the method of Tschirnaus can be applied to equations of the fourth degree in making two terms of the proposed vanish, it will not be useless to see further what would result from it if we wished to make all the intermediate terms vanish at the same time, as we have done for the third degree."

The paragraph between the inverted commas is translated from a passage in a paper of LAGRANGE, printed in the *Nouveax Mémoires de l'Académie Royale* (of Berlin) for 1770. The passage forms the commencement of Art. 41 of that paper, and will be found at the foot of page 197 of the *Mémoires*. It heralds an *à priori* inquiry into the existence of such a transformation. As might be expected, the inquiry is conducted by taking advantage of, what we may call, the *secondary* properties of the fourth roots of unity—properties, some of which have been adverted to in Nos. 3 and 4 of these Notes (c). The conclusion arrived at by LAGRANGE, viz., that such a transformation is possible without our having to solve an equation of a degree higher than a cubic is, of course, dependent on the existence of these secondary properties.

In order to see this clearly, we have only to turn to page 199 of the (*Berlin*) *Mémoires* for 1770. It will be found that the equation at line 11 of that page involves, in its formation, the relation which I have in these *Notes* (d) represented by

$$1+a^2=0\ldots\ldots\ldots(1),$$

and depends for its existence upon that relation. So, it is only (which amounts to the same thing) because

$$a+a^3=0,$$

that we can form the equation at line 12 of that page. Further, from the equation (1) we may deduce

$$1-a^2=2,$$

and it is by means of this relation that

(a) No. 6 will be found *ante*, page 516.
(b) *Ante*, page 423.

(c) Vide *ante*, page 180 (No. 3) and page 420 No. (4).
(d) *Ante*, page 420.

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we obtain the equation at line 19 of the same page. So we must avail ourselves of the condition

$$a-a^3(=2a)=-2a^3,$$

in order to arrive at the equation at line 20 of the page just cited. But enough has been said to satisfy the reader that this inquiry *à priori* (*e*) founds the possibility of the proposed transformation on the secondary properties of the fourth roots of unity. And the success of the "ordinary method" (*e e*) is thus accounted for.

For a very clear view of the necessity of employing the above relation (1) when we are considering the forms of the roots of biquadratics, I would again refer the reader to a paper by GERGONNE, at pages 137—9 of tome iii. of the *Annales de Mathematiques*. I do not at present advert to the remarks of LAGRANGE upon (*f*) the methods of EULER and BEZOUT, because the labours of these distinguished men have not yet been discussed in the present *Notes*. The reader will also, perhaps, have observed the omission of a notice of the researches of RUFFINI. Had these *Notes* been constructed upon a fixed plan, instead of being the results of such reflections as presented themselves during the progress of the papers, I should, perhaps, be fairly charged with want of system. I hope however to rectify errors and to supply omissions as another Series of these *Notes* proceeds, and I would not have it supposed that the defects above enumerated are all which I shall have to remedy. On this very subject of biquadratic equations, I have not yet noticed the method of resolving them proposed by Professor J. R. Young of Belfast. (*g*).

(*e*) This term "*à priori*" is used by LAGRANGE.—J. C.

(*e e*) *Vide ante*, page 421, concluding paragraph (a quotation.)

(*f*) See page 207 of the above *Mémoires* for 1770, where LAGRANGE adverts to "la méthode que Mrs. Euler and Bezout ont proposée pour la resolution des équations du quatrième degré," and which method in one instance involves *fourth* roots of unity and is closely related to the transformation mentioned in the text above. Further on (at p. 213 of the same volume of those *Mémoires*) in LAGRANGE's paper will be found, under a different notation, the three-valued function noticed in the course of a solution of a biquadratic (by Mr. Greatheed I believe) given in vol. i. of the *Cambridge Mathematical Journal* (pp. 254—6).—J. C.

(*g*) See Professor Young's *Theory and Solution of Algebraical Equations*, 2d edition (London, 1843)—an excellent work. I allude more especially to the latter part of it which treats of *algebraic equations*, and which displays on the part of the writer a great insight into the subject. The question is discussed with much clearness, elegance, and power.—J. C.

With these remarks will conclude my *First Series of Notes on the Theory of Algebraic Equations*.

I am, Sir, yours, &c.,

JAMES COCKLE.

2, Church-yard-court, Temple,
June 7, 1847.

Postscript. The following corrections should be made in preceding *notes*:

Page 123, col. 2, note *, the note * should commence with the words, "As to this last species of equation."—J. C.

Page 178, col. 2, note ‖, *for* 69 *read* 99.

Page 422, col. 2, line 3 from bottom, *for* y *read* y^4.

Page 516, col. 2, line 17 from bottom, *omit* the comma after "palpably."

Page 517, col. 2, line 9 from bottom, *omit the semicolon.*

ALBAN'S "HIGH PRESSURE STEAM-ENGINE INVESTIGATED."*

WE English have long had a notion that we know more about steam-engine making, in all its varieties, than any other people on the face of the globe,—that we make better engines than any, and turn them to much better account; and the world at large, with the exception, perhaps, of a certain neighbouring country, which will never allow superiority in anything to "*la perfide Albion*," has by its preference of English workmanship, its adoption of English models, and its constant reference to English examples and authorities, done all in its power to foster this national belief. With respect to high-pressure steam, in particular, and the expansive system of working, growing out of it, we have been hitherto accustomed to look on our own little island, as being not only the true birth-place of both, but as the country where they have been practically carried out to the greatest beneficial extent. And, if asked heretofore for proofs, we should have pointed exultingly to our mines, to our river and ocean steam navigation, and to our railways.

Alas! (whispers a voice in our ear) that any people should be so puffed up with vain conceit,—that ever the world should have been so mistaken. From the depths of

* "The High Pressure Steam Engine Investigated. An Exposition of its Comparative Merits, and an Essay towards an Improved System of Construction; adapted especially to secure Safety and Economy in its use." By Dr. Ernst Alban, Practical Machine Maker, Plau, Saxony. Translated from the German, with notes, by William Pole, F.R.A.S., Professor of Engineering in Elphinstone College, Bombay, &c. 145 pp., 12mo., with plates. Weale.

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Saxon forests—the Luther-land of new lights and new creeds—there cometh one who proclaimeth, "'Tis all fudge!—Neither did the English invent the high-pressure engine, nor have they made any account of it at all. What they know of it, they have borrowed, and what they do not understand, they have made a joke of. The workmanship of their high-pressure engines is execrable, and their performances deplorable!"

And who is the redoubtable Saxon who maketh these bold charges? One "Ernst Alban," a "doctor" (whether of law, or medicine, or physics, is not stated) and a "practical machine maker," to boot, of "Plau," (Paw, Paw?) in Saxony, who says he has devoted some thirty years and more of his life to the theory and practice of the high-pressure steam-engine, and, by dint of much hammering, and pokering, and pondering, has discovered—what he hath discovered.

To whom, then, are the laurels said to belong? To the Chinese, or the Esquimaux? No, faith!—To Jean Crapaud and Brother Jonathan!!! Don't laugh, reader, but attend to the *ipsissima verba* of our Saxon luminary:

"To Oliver Evans (of America) it was *reserved* to show the true value of a long-known principle (expansion), and to establish thereon a new and more simple method of applying the power of steam,"—(p. 12.)

"The English have, in a great measure, assisted in bringing this form of engine into discredit;—*if not by open attacks, yet through the bad construction and arrangement of their engines:* and it would have stood a chance of again passing into oblivion, had not *the French*, at a late date, bestirred themselves to prevent its downfall, by examining and making known its advantages, and by a series of gradual improvements in its construction. *America and France remain* THE ONLY SUPPORTS *of the* SYSTEM,"—(Introduction, p. 6.)

Indeed! indeed! And can all this be really true? Let us see what truth and history testify on the subject:

When Oliver Evans was yet but a lad, not out of his apprenticeship (1769), and half a century, at least, before he was ever heard of in Europe, the whole theory of working steam expansively was developed in a well-known letter (28th May, 1769) from JAMES WATT to Dr. Small.* No one has, to this day, been able to show an earlier title to the invention; nor has any one to this day set forth its advantages more distinctly or clearly.

Watt introduced engines on the expansive system, at the Soho Works, as early as 1776, and at the Shadwell water-works, London, about 1778. Oliver Evans's first expansive engine was not made till 1800, or 1801, full thirty years later.

The Cornish system—which is but the high-pressure expansive system in its highest known state of development—has been in a course of constantly progressive improvement since the days of Watt, and has conferred incalculable advantages on the British empire. It is a commonly received opinion in Cornwall that more than half of its best mines would have been now buried under water, but for what high-pressure steam and expansion have done for them.

The Railway system which is now fast changing the whole face of the world, and is but another grand result of high-pressure steam, was first matured in England, and has been carried here to a pitch of perfection (we speak now of it as an instrument of speed only) unrivalled all the world over.

The French who, according to Dr. Alban, took the high-pressure expansive system so kindly under their wing, when the underhand attacks of the English, and their ill-constructed engines were bringing them into discredit, have never had a high-pressure expansive engine worth anything which was not either introduced by Englishmen from

* "I mentioned to you a method of still doubling the effect of the steam, and that tolerably easy, by using the power of steam rushing into a vacuum, at present lost. This would do little more than double the effect, but it would too much enlarge the vessels to use it all. It is particularly applicable to wheel engines, and may supply the want of a condenser where force of steam only is used; for open one of the steam valves, and admit steam until one-fourth of the distance between it and the next valve is filled with steam; shut the valve, and the steam will continue to expand, and to press round the wheel with a diminishing power, ending in one-fourth of its first exertion. The sum of the series you will find greater than one-half, though only a fourth of the steam was used. The power will, indeed, be unequal; but this can be remedied by a fly, or several other ways."

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England, or built by Englishmen in France, or built by Frenchmen from English models.* And for every franc which the French have realized from the system the English can count their hundreds of thousands of pounds sterling.

What, then, can have led this silly German doctor to promulgate statements at such palpable variance with notorious facts? Need we insist that he must be either miserably ignorant, or impudently mendacious? Possibly he may be neither the one nor the other; only dreaming a little, *more Germanicæ*.

While denying all merit to Watt in regard to working steam at high-pressure expansively, Dr. Alban owns, at the same time, that the philosopher of Soho was nevertheless a great man,—" a dazzling meteor whose brilliant ray illumined the darkness of his age.' But apparently he only makes this concession that he may indulge with the greater plausibility and effect in such sweeping disparagement, as the following, of those Englishmen who have followed in the steps of their illustrious master:

" But his light is extinguished, and since his time its place has only been supplied by the *dim tapers* of his followers and imitators, whose dulness seems rather to recall the ancient darkness than to perpetuate or renew the splendour which his great spirit threw upon the world."

A " dazzling meteor" truly was WATT; yet neither assuredly have his followers been such " dim tapers" as this Saxon churl alleges. It were enough, perhaps, to show the absurdity of the imputation, to mention simply the names of a few of these " dim tapers,"—TREVETHICK, WOOLF, HALL, NAPIER, MAUDSLEY, FIELD, SEAWARD, RENNIE, BROWN, MILLER, FAWCETT, FAIRBAIRN, WITTY, STEPHENSON, SIMS, PENN! All eminent! All disciples who would do honour to any master. Not " followers and imitators" merely, but men who have been thoroughly imbued with the spirit of their illustrious chief—who have *more* than worked out all the views and plans which he bequeathed to them—who have extended the domain of steam far beyond whatever Watt in his most enthusiastic visions ever contemplated—who have developed applications of steam power which Watt never thought of, and who have since the days of Watt multiplied a hundredfold the benefits which steam has conferred on mankind. There may be no single Elisha on whom the mantle of the Elijah of Engineers has fallen; but it is only because there are many Elishas.

What an obscure German doctor may think of English engines and English engineers, would, after all, be of no moment, and would have provoked not a word of remark from us, were it not that his mistatements and misjudgements happen to come before us, countersigned by an Englishman, to whom his countrymen have been hitherto accustomed to look up as no inconsiderable authority in such matters. The translator of Dr. Alban's book is Professor Pole, of the Elphinstone College, Bombay, so well known to our engineering readers for the best account extant of the Cornish engine, and for other able productions relating to steam power. The Professor does apologize for " the usual prejudice of the author against England," (p. 6); he even protests against some of his aspersions (13), and for decency's sake wholly suppresses others (106), but upon the whole, he rather agrees with him than otherwise, in his estimation of English engineers. Witness the following passage of the Professor's " Advertisement:"

" Now it cannot be denied that ever since the time of Newcomen, the attention of the English has been almost exclusively directed to that modification of the steam engine which depends for its source of power principally upon the *condensibility* of steam, namely, the *low-pressure condensing engine*, in which a very moderate elasticity is used. The other great class, comprising that variety of engine which owes its efficiency principally to the *elasticity* of the steam,—the HIGH-PRESSURE ENGINE,—is (or at least was a very few years ago) scarcely known among

* The first double cylinder high-pressure engine seen in France was introduced by Messrs. Hall and Son, of Dartford, who have ever since been large makers of this description of engines for French entablishments; and after them came Mr. Edwards, who set up a manufactory in Paris for the purpose of supplying the Woolf engines, now so common in France.

us in comparison. While we find the condensing engine studied carefully, treated of most voluminously, and manufactured by wholesale, we deplore the neglect which the high-pressure engine has suffered;—we look in vain for information upon it; and we are scarcely able to point, even in the present more cultivated field of locomotives, to a solitary specimen deserving the name of an economical producer of steam power. Surely then, while we have done so little with this variety of the machine, we need not scruple to attend to the investigations, and to profit by the experience, of those who have done more; and it is on this ground we invite attention to the following pages.

"It must startle English Engineers not a little to be told that the high-pressure engine is both safer and more economical in its use than the low-pressure condensing one; yet such is the declaration of our author, who, according to his own showing, appears to have devoted more attention to the high-pressure engine than perhaps any other engineer now in practice. On this account, if for no other, the work we now lay before the public is worthy of a careful and impartial examination."

Witness also the following note by the Professor on a note of Alban's, in which the latter twits English engineers "with" perhaps adopting "the vulgar error that a fly-wheel increases the power of the engine:"

"We are sorry to say that the scientific and engineering literature of our country shows but too many instances where persons may be found to propagate and defend the doctrine of either gain or loss by the fly-wheel, or of loss by the crank or connecting-rod; or, in short, any other absurdity. Let us hope that the light of science is now so far spreading amongst us that these blots on our philosophical character may soon only be matter of history." p. 10.

We regret extremely that a gentleman who stands so high in general esteem as Mr. Pole, should have identified himself to so large an extent with the anti-English engineering balderdash of Dr. Alban. The author of the "Treatise on the Cornish Engine," should have been the last man in the world to deplore the "neglect which the high-pressure (Cornish) engine has suffered" amongst us, or to say that "we look in vain for information upon it." Is Cornwall out of England, that it is not to be taken into account in judging of what England has done for the high-pressure engine? And where, in all the world, has the high-pressure steam-engine been in higher favour, or been productive of larger results, than in Cornwall? Mr. Pole's qualifying phrase of "at least a very few years ago," will not help him out of the false position to which he has committed himself. The high-pressure engine has *always* been better known and more extensively used in England—that is, England in the sense of comprehending the whole soil of England (which is the only correct sense of the term), and not any particular county or district of it—than in any other country whatever. It may have had less attention paid to it in the metropolis than in the provinces—in manufacturing Lancashire than in mining Cornwall; but what of that? By what title does any foreigner pretend to say, "I can look only to what you have done in the east, and north, and south, and cannot allow you an atom of credit for what you have done in the west?"

Mr. Pole might have recollected, too, that besides his own excellent "Treatise on the Cornish Engine," there is the valuable work of Mr. Wickstead, devoted to the purpose of setting forth its manifold advantages. Nor can he be ignorant of the numerous discussions of which the Cornish engine, has at different times been the theme. at the Institution of Civil Engineers—for, if our memory serves us rightly, Mr. Pole himself took a part in some of them.

How Mr. Pole could, under such circumstances, bring himself to say, that "*it must startle* English engineers *not a little* to be told that the high-pressure engine is both safer and more economical in its use than the low-pressure condensing one," is to us perfectly unaccountable. Why, who is there amongst English engineers who does not know that? How few who do not know all about it, quite as well as either the great gun of Plau or his Bombay translator? *Startled*, no doubt, they will be, one and all—but at the amazing assurance only, which could impute to them such amazing ignorance!

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Just as imaginary are those other "blots on our philosophical character," of which Mr. Pole thinks we have reason to be ashamed. There are people amongst us he says who have been "found to propagate and defend the doctrine of either gain or loss by the fly-wheel, or of loss by the crank, or connecting-rod, or, in short, any other absurdity." If we were at liberty to suppose that Mr. Pole referred to those (a very few in number, and to be found only amongst the most illiterate) who fancy that the fly-wheel has a power-creative property in itself, and that the crank and connecting-rod are absolute destroyers of, and not helps to power, no shield of ours should be interposed to save them from his shafts. But his words seem more obviously to imply that in his own opinion there is positively neither *gain* nor *loss* attending the fly-wheel—*no loss* whatever resulting from the crank and connecting-rod—and that all are guilty of prodigious "absurdity" who entertain an opposite opinion. May we venture in all humility to doubt whether Mr. Pole can make good so absolute a position? If there is positively neither gain nor loss attending the fly-wheel, what sensible reason can Mr. Pole give for employing it at all? Power in itself, the fly-wheel of course has none; but inasmuch as every fly-wheel does confessedly increase the efficiency of the machine to which it is attached—causes it to work more uniformly and steadily—enables it to do *more duty* in a given time than it would otherwise do—we submit that it may with perfect truth be affirmed of the fly-wheel in general, that it is a real and valuable source of power. In the same way as the dam adds not to the water in a river, yet adds immensely to its efficacy as a motive power, so will the fly-wheel, though it adds nothing to the absolute power of any first mover with which it is connected, it adds largely to its *applicate* efficiency and value. The case of the crank and connecting-rod is much the same. It can no more be said of them that they are obstacles to the rotary movement of a machine, than that the legs of man are obstacles to his walking power; yet is it nevertheless indisputably true that all transmitted motion is transmitted at a loss, and that the motion therefore which requires a crank and connecting-rod for its medium, must of necessity suffer a diminution from that medium more or less.

Be all these points, however, as they may,—be the "absurdity" ever so great which English writers have broached respecting them—this, at least, is certain,—that there have never been wanting Englishmen enow of an opposite stamp, to do battle for just and sound views on these, as on all other subjects. Why, then, should our "philosophical character" be judged of from the few rather than the many—from the dullards alone, and no account be taken of the men of sense and intelligence? We read, in fiction, of the whole people of a town being set down in the book of a tourist as red-haired, because a forbidding landlady happened to be so; but this is the first time, within our recollection, of such a style of reasoning being adopted in matters of such sober reality as fly-wheels, cranks, and connecting-rods.

We freely concede to Mr. Pole that the circumstance of Dr. Alban being a foreigner, is no reason why we should not avail ourselves of such information as his great experience ("according to his own showing") has enabled him to set before us. We will go even farther, and admit that there are a great many good things in his work; and, were it not that so much of our time and space has been occupied in repelling his groundless and offensive charges against English engineering and engineers, we should have had much pleasure in giving some specimens of the more creditable portions of its contents. As it is, however, we must reserve this act of justice for some future opportunity.

HEATHER'S "MECHANICS."

Sir,—I was tempted by Mr. Heather's advertisements in the papers to order his work. I have been supplied with two numbers only, and two months have passed

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without the promised monthly addition. How is this, can you tell me? Is the work discontinued? If it be, might I not consider myself to be very shabbily treated—in fact, "jockied" out of five shillings? Does the law allow me no remedy, by compelling the author to complete his contract with me, or else return the money advanced by me on the faith of his contract with me? The law, I believe, binds *me* to complete the purchase in the case of his completing the work; and it does seem somewhat hard that the contract should be capable of enforcement on one side and not on the other. Pray, Sir, advise me how to act.

I am, Sir, yours, &c.,
R. S.

[We advise "R. S." to be thankful that his loss extends to no more than five shillings—it threatened to be four or five times as much. Our correspondent must be a somewhat simple-minded person to be caught with such an advertisement as Mr. Heather's; and if his two half-crowns shall have taught him to look upon such conceited announcements with caution, they will not have been spent uselessly. One of our correspondents suggests as "the true cause of the death of the late Mr. George Robins, his finding himself outdone in his own line, by Mr. John Fry Heather!" Mr. Heather, it appears however, is not to enjoy the monopoly of auctioneering authorship: for he has found his match in in the Rev. Harvey Goodwin, of Cambridge, who has excited "great wonderment" in his university by his display of this kind of eloquence, in a recent preface. Of both these candidates for sale-room eminence we shall hereafter have something to say: but for the present we offer to "R. S." the consolation, that his first loss is his least loss.—Ed. M. M.]

FALL OF THE DEE IRON BRIDGE ON THE CHESTER AND HOLYHEAD RAILWAY.

The Chester and Holyhead Railway is carried over the river Dee by an iron girder bridge of three bays or spans, of 98 feet each. While a railway train was passing over it on the 24th ult., one of the girders of the bridge gave way, and the greater part of the train was precipitated into the river, five persons were killed, and several wounded.

A great difference of opinion, as is usual in such cases, prevails respecting the cause of the accident.

Mr. Thomas Yarrow, C. E., thinks that the accident was caused, not by any defect in the girder, but by a defect in the masonry which supported it. "From calculations which he has made of the strength of the girders, taken from an actual admeasurement of the section at the point of fracture, he finds, that independent of any additional strength that might be obtained from the tension bars, the girders alone were capable of *sustaining a much greater weight than could at any time be placed upon them.*" But he considers the masonry that supported the girders to have been "totally inadequate in its form and bearing surface to the purpose." The "lateral force acting during the passage of the trains, must have so far loosened the inefficient masonry as to cause a displacement of the girder, and its consequent fracture."

Major-General Sir Charles Pasley (late Inspector-general of Railways) surveyed the bridge on the 20th of October, and reported it *to be safe*. He had been led to this conclusion because there had been a number of bridges of this description erected on railways in various parts of England, none of which had failed. He instances in particular the cast-iron girder bridge at York, over the river Ouse, which has two openings of 70 feet span, and on which the least depth of the girder is 3 feet; while the least depth of this over the Dee is 3 feet 9 inches. "As the bridge at York, and other similar bridges, have stood, I concluded that this one would, as it had an extra depth to render it safe." But now that the Dee bridge has fallen, in spite of his calculations, the General inclines to think that such bridges "are not safe, and *that it is a mere cast of a die between their safety and danger!!!*" The immediate cause of the present disaster was, in his opinion, a weakness in the girder, and not any defect in the masonry. "The masonry gave way from the girder breaking, and from that cause alone." Tension rods he thinks of no use whatever; seeing that they have no *independent support*, but are themselves dependent on the girder which they are supposed to strengthen.

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Mr. ROBERT STEPHENSON, the engineer of the bridge, insists that there was nothing whatever the matter with it, and ascribes the disaster to the locomotive tender having gone off the rails, and given a violent blow to the side flanges, which broke the girders, which loosened the masonry, &c.

Mr. JOSEPH LOCKE, C. E., concurs with Mr. Stephenson in thinking that it was the side blow which did the mischief; but, at the same time, he considers "all manner of iron bridges objectionable when brick and stone bridges can be had, as is the fact, cheaper and better."

So much for what others think; and now for a word or two of our own upon the subject. We agree with Mr. Locke, that iron bridges—no matter how constructed—are wholly unsuited for railways; and if there be many more erected in England, we can but expect an early and frequent recurrence of accidents similar to the present. We do not know what Mr. Locke's reasons are, for he does not give any; but we will state our own. The question does not, as Mr. Yarrow supposes, turn on the amount of direct insistent weight which an iron bridge can be made to bear (for it may be made to bear any weight)—but on its capability to withstand the peculiar sort of concussive force exerted by a railway locomotive and train. All military men are familiar with the fact, that a suspension bridge which will withstand the tread of a body of soldiers marching irregularly—all acting on it in different directions and at different times, the movements of one counteracting the movements of another, and no two moving either similarly or simultaneously—will break down under the measured tread of half the number. In the one case, the disturbing force is distributed, dissipated, and no harm done; in the other, it is concentrated, accumulated, and destruction follows. Now, the measured tread of marching soldiers is precisely analogous to the regular strokes of the piston of a locomotive engine. No iron can stand such thumping long, because of its extreme rigidity, and consequent liability to fracture, unless where the distance is short and the strokes few, and stone or brick piers are close at hand to absorb the concussions. Wood stands it better—nay, well,—because it is elastic and resilient. But masses of stone and mortar, or brick and mortar, stand it better, because of the innumerable parts of which they consist, and of the rapid dispersion of the concussive force amongst them. Mr. Locke, therefore, is right;—no railway bridges should be of iron; of wood they may be; but better far of brick or stone.*

General Pasley's position in regard to the matter is not an enviable one; yet there was much truth in what he took occasion to say of the manner of constructing the bridge. Tension-bars, as here applied, *are* useless,—that is, tension bars, having their bearings *within the girder itself*. The idea that any strength can be gained by them is preposterous; they add so much breaking weight to the girder, and that is all.

GUTTA PERCHA—APPLICATION TO SUCTION PIPES.

Sir,—I beg to mention an application of gutta percha, which I have lately made with complete success, and which, I believe, is novel, viz., to the covering of flexible suction pipes, such as those of fire-engines.

Having had occasion for a very strong and staunch suction-pipe, of six inches diameter, I caused the spiral inside hoop to be covered all over with a sheet of gutta percha of about $\frac{3}{16}$th of an inch thick. This was laid on evenly and tightly, with ease, from the facility that gutta percha affords for soldering when heated. This flexible case was alone quite air-tight, and was made also air-tight to both couplings at the ends, by soldering to them hot. The whole was then sewed over with moderately thick leather, tied in the usual way to the couplings —the only object of this being to protect the gutta percha from mechanical injury. The whole suction-pipe is perfectly air-tight, flexible, and pleasant to work.

For ordinary fire-engine suctions, the gutta percha should not be more than one-eighth of an inch thick.

I am not aware that this mode of making

* For example, such a bridge as Mr. George Rennie has just built at Val St. Lambert over the Meuse, for the Namur and Liege Railway. It is of stone, and consists of five arches, of 82 feet span each. The arches are segments of a circle—versed sine 10 feet. It is a very elegant and manifestly stable structure.

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suction-pipes has been before tried; but I am satisfied it is a considerable improvement upon the usual method, and hence give you this short notice of it.

I am, Sir, yours, &c.,

ROBERT MALLET.

Dublin, June 7, 1847.

BARON VON RATHEN'S COMPRESSED AIR LOCOMOTIVE.

In the course of some very able papers which appeared in this journal a few months back, by "x^2," "On the Power attainable by the Exhaustion and Compression of Air," (vol. xlv., p. 461—508), reference was made to "a company supported by some highly scientific names," as being in the process of formation, to carry out a compressed air system of propulsion patented by Baron Von Rathen, of which the writer of the papers appeared to entertain a more favourable opinion than of any plan of the kind yet brought before the public. On Thursday last, we had the pleasure of witnessing, at the College for Engineers, Putney, some experiments made in the the workshop of that establishment, to test the practicability of Baron Von Rathen's system; and were rather (unexpectedly, we confess) gratified at the results. We saw air compressed with facility to nearly 60 atmospheres, or upwards of 850 lbs. per square inch, and the power thus accumulated set free again for motive purposes, without either branch of the process being attended with any of that evolution of excessive heat which has been hitherto supposed to be an insurmountable obstacle to the employment of compressed air as a motive agent. The ingenious inventor not having as yet perfected his various patent rights, we are precluded from entering at present into further particulars. In the workshop, where the experiments took place, we saw a common road locomotive in progress of building, which is expected to be finished and at work in August next.

THE PLANET NEPTUNE.

Mrs. Borron, of Croydon, has publicly stepped forth, and insisted that Neptune is not the body sought for by Le Verrier's investigation, but a planet which happened accidentally to be in the field of the telescope when Dr. Galle made his scrutiny. Since this assertion was publicly made, our brethren on the other side of the Atlantic have arrived at the same conclusion, and have supported Mrs. Borron's paradox by $x+y-z$. There are certainly perturbations still to account for; and, the mean distance of Neptune proving to be much less than the limits assumed, may indicate a change in their very character. Professor Peirce communicated to the American Academy of Sciences, 16th March, 1846, the computations of Mr. Sears C. Walker, who had detected a missing star in the *Histoire Céleste Francaise*, observed by Lalande on the 10th of May, 1795, near the path of the planet Neptune, at that date, which may have possibly been the planet in question. Mr. G. P. Bond joined in the scrutiny of all the data; and the conclusion which these gentlemen have arrived at is, *that the planet Neptune is not the planet to which geometrical analysis had directed the telescope.*

Let the whole corps of geometers look well to this, and unveil the happy accident to which the discovery of Galle is owing; let them tell how queerly Lalande allowed Neptune to slip through his fingers, after catching him on the 8th and 10th of May; and let them revise the now faulty elements of the complicated motions before them.—*United Service Magazine.*

The Joseph Miller is the name of a new iron paddle-wheel steamboat, which has been just built for the Dusseldorf Steam Navigation Company, by Messrs. Miller, Ravenhill, and Co., and so named in honour of the head of that eminent firm—an honour not less merited by high professional attainments than by all those qualities which dignify and adorn private life. We should much like to see this practice of naming steamers after our distinguished marine engineers more in vogue than it is. The "*James Watt*," the "*William Fawcett*," and the "*Aaron Manby*," are the only previous instances of the sort which we can call to mind. Yet who more deserving of having their names wafted to every shore, than the men by whose genius and skill the pathway of "those who go down to the sea in ships" has been freed from all its former uncertainty, and more than half of all its perils? *The Joseph Miller*, being intended for river navigation, is of exceedingly slight draught—not quite three feet; her engines are of the beam class, and of eighty horses power; the paddle-wheels are of the ordinary sort. She made her first trial trip down the river on Wednesday of last week, when her mean speed was found to average not less than 13½ miles an hour. This is the fourth vessel, and her engines the seventh, made by Messrs. Miller, Ravenhill, and Co., for the same Company.

LIST OF ENGLISH PATENTS GRANTED FROM JUNE 7, TO JUNE 10, 1847.

Richard Clark, of 447, West Strand, lamp manufacturer, for certain improvements in the production of artificial light, and in burners, lamps, and candlesticks. June 7; six months.

Samuel Ellen, of Grange-road, Bermondsey, gentleman, for improvements in the manufacture of both hide leather and other oiled leathers. June 8; six months.

Charles Jarrard, of Leicester, machinist, for improvements in machinery for cutting wood for the manufacture of bobbins and other articles. June 8; six months.

William Darling, of Glasgow, Scotland, ironmonger, for improvements in moulding, and in the manufacture of certain articles of cast-iron. June 10; six months.

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Sandy Azulay, of Rotherhithe, Surrey, printer, and Abraham Solomons, of the city of London, merchant, for certain improvements in the manufacture of charcoal and other fuel. June 10; six months.

Henry Cox, of No. 9, Chappel-place, Battersea fields, for improvements in the preserving and preparing of wood, bricks, tiles, and other substances. June 10; six months.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.		No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
June	5	1089	Joseph Arnold	24, Upper Marylebone-street	Music stool.
	,,	1090	Isaac Brampton, sen., and Isaac Brampton, jun.	Leicester, glove-manufacturer	Looped fabric glove.
	,,	1091	Jeremiah Smith	42, Rathbone-place	Envelope.
	7	1092	Robert Blundell	Theberton-street, Islington, land-surveyor	Improved drawing level.
	,,	1093	Edward Varney Pledge	311, Cheapside, Birmingham.	Agate whip handle.
	9	1094	Thomas Glover	47, Myddleton-square, Clerkenwell	Apparatus to cover over the joint of a gas-meter pipe, in order to prevent fraud in the use of gas-meters.
	,,	1095	John F. Shaw	Albion-street, Cheltenham	Saddle apron.
	10	1096	Simcox, Pemberton & Sons	Birmingham	Improved stair rod.

Advertisements.

TO MINE AND COLLIERY PROPRIETORS, SLATE QUARRY OWNERS, RAILWAY CONTRACTORS, IRONMONGERS, DEALERS IN GUNPOWDER, AND OTHERS.

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Also, in tubes or cartridges of... 1, 1⅛, 1¼, and 1½ inch diameter;
Containing .... 2, 4, 6, and 8 ounces each, at the
Additional charge of........ 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 3 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

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THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

E. GRANVILLE, Manager.

London, May 17, 1847.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

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To Inventors and Patentees.

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Spence on the Specification of a Patent.

This day is published in 8vo., price 7s. 6d., boards.

A TREATISE on the Principles relating to the Specification of a Patent for Invention; showing the standard by which the sufficiency of that instrument is to be tried.

By William Spence, Assoc. Inst. C. E., Patent Agent.

London: Stevens and Norton, 26, Bell-yard, Lincoln's-Inn, and 194, Fleet-street.

NOTICES TO CORRESPONDENTS.

E. M.—To both questions—" Yes." If E. M. will send to our office, he will find a note left out for him.

" W. O."—An early place.

" Gravidus."—Declined.

Communications received from T. T. R.—Mr. Petrie—J. E.—Mr. N. Bridges—F. F.

Confirmation of Patents.—*The Privy Council alone can confirm; none but a* confirmed fool *would imagine that any private individual has the power.*

R. P. " We would remark" that people fond of frays are not often safe guides. And " note" that the " prince of verbosity" is at the same time a man of rare information and sound judgment.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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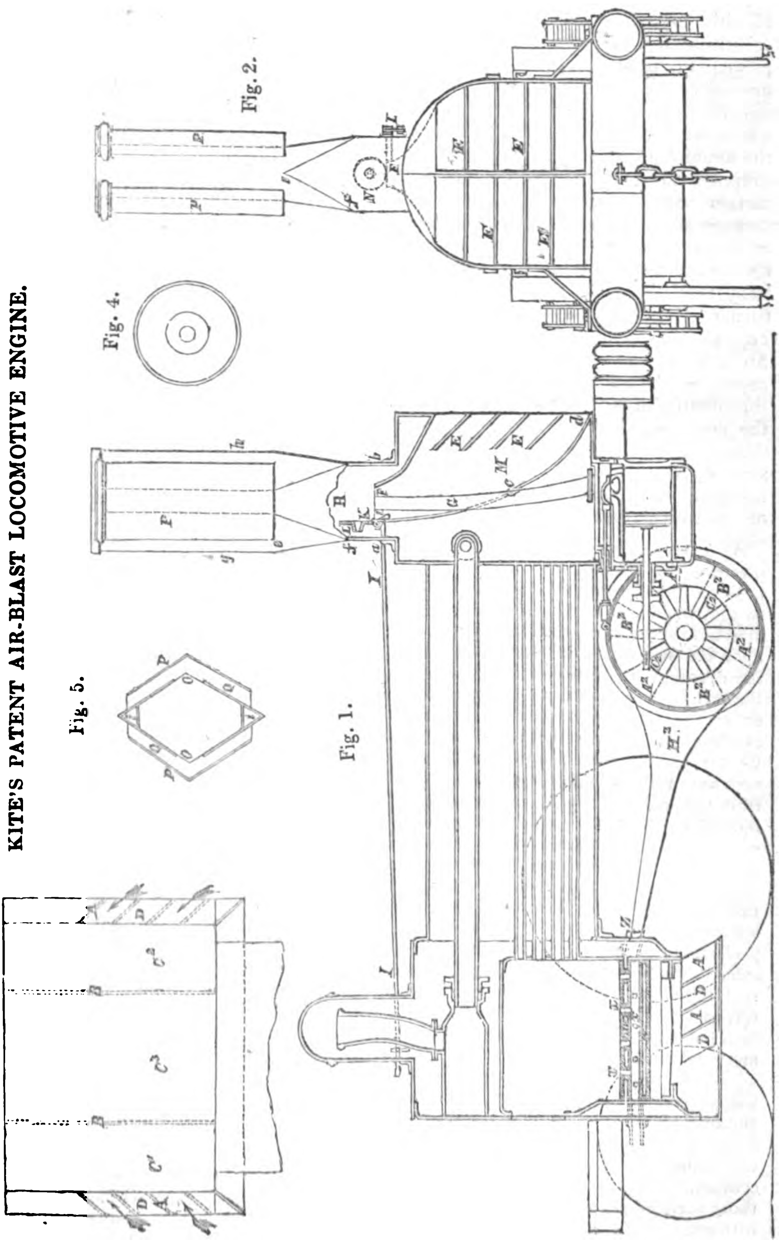
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1245.] SATURDAY, JUNE 19. [Price 3*d*.

Edited by J. C. Robertson, 166 Fleet-street.

KITE'S PATENT AIR-BLAST LOCOMOTIVE ENGINE.



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KITE'S PATENT AIR-BLAST LOCOMOTIVE ENGINE.

[Patent dated Oct. 15, 1846. Patentee James Kite, of the New North-road Bridge, Hoxton.]

MR. KITE's distinguished success in ventilation has led him to apply his skill in this branch of art, to find out a substitute for the steam blast now employed to produce the necessary degree of draught in the chimneys of locomotive engines, and which is attended with a waste of power proportionable to the amount of steam so expended. He proposes to apply deflecting plates to certain parts of the engine, and so to arrange and dispose them, that portions of the atmospheric air encountered and driven aside by the engine when in motion, shall be directed either into the furnace, or the smoke-box, or the chimney, so as to cause a draft through the fire sufficient to keep up the requisite degree of combustion, and to produce the quantity of steam required for driving the engines. Fig. 1 is a sectional elevation of part of a locomotive engine constructed on this plan; fig. 2 is a front elevation of the same; and fig. 3 a plan of the ash-pit and fire-box.

A A are a series of deflecting plates placed on the sides of the ash-box, and in a position inclining from the bottom upwards; so that when the engine is moving in the direction of the arrows, as the air impringes upon the plates A A, it is deflected through the openings D D, between them, towards the fire-bars and into the furnace. B B are two vertical partitions which divide the ash-box into three longitudinal chambers C^1 C^2 and C^3, and are intended to prevent any injurious effect which might result from the introduction of an opposing current of air, when the wind happens to be not in a direction parallel with the line of motion of the locomotive. The deflecting plates A A are represented in the figures as being a little shorter than the depth of the ash-box, but they may be made longer if preferred by being carried further up on the sides of the fire-box, the openings D D being still left of the same length. E E are a second series of deflecting plates which are inserted into the front of the smoke-box, and lead into a chamber terminating in an annular opening F F, which surrounds the exhaust pipe G. A sectional plan of the chimney on the line *a b* is given separately in fig. 4. The atmospheric air, with which the deflecting plates E E are brought in contact, is in a great part by the action of those surfaces propelled up the chimney H, with more or less force according to the velocity of the locomotive at the time, and to the direction in which the wind is blowing.

The pipe G is made of sufficient size to allow of a free exhaust of steam from the cylinders, without producing what is termed any "back action upon the piston." Should, however, the driver of the locomotive have, on an emergency at any time, to revert to the old or ordinary mode of obtaining a blast by the contraction of the exhaust-pipe, he has only, by means of the lever-handle I I, to bring down the door or valve K, which will shut off the air from entering the openings between the deflectors E E, and drop over the mouth of the pipe G a nozzle L, which will contract the opening for the escape of the exhaust steam, and put the blast in the same position as it is now generally employed in locomotives.

The deflectors E E are fixed in two frames hinged one to each side of the smoke-box, so that access may be readily had to the tubes or flues. And for the same reason the back of the chamber M is made movable from *c* to *d*, being hinged at its upper edge *c*. N is the under portion of the chimney, which is made at bottom of a circular form, but from *e* to *f* is contracted upon the two sides, and correspondingly increased in diameter from front to back, until at *e* it assumes in the section a regular diamond form, as represented in fig. 5, which is a section of the chimney taken on the line *g h* of figs. 1 and 2. O O are two side openings in the chimney, which are covered with two double deflectors, P P, which are attached to the chimney by plates at top and bottom, which close in the intervening spaces Q Q between the diamond chimney and the side-plates P P.

When the locomotive is in motion, or the wind is blowing upon the chimney, either in back or front, or upon any of the sides, then a partial vacuum is produced inside, and a corresponding action produced upon the fire, from the rushing of the air through it to supply the void in the chimney. In some cases, instead of leaving open the top of the diamond-shaped chimney just described, it is proposed to close it up, and leave one or more smaller passages *i i* for the escape of the waste steam; or the waste steam may be allowed to escape from a pipe placed outside the chimney—in which case, there will be no occasion for the smaller passages *i i*.

"In the arrangements," says Mr. Kite, "which have been just described for producing the requisite draught in the furnaces of locomotive engines, without the aid of the ordinary exhaust blast-pipe, the ash box,

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the smoke-box, and the chimney are represented as having each deflecting plates or surfaces attached to it, and the whole have been supposed to be in action at one and the same time; but it is nevertheless to be understood that each of these sets of deflectors is quite independent of the others in its action, and that any one, two, or all three of them may be employed according as circumstances may render expedient. Neither is it essential that the chimney deflectors should always be placed in the vertical positions represented in the figures, for they will also act very effectually if placed in a horizontal position. And further, the means of producing a draught described under this head may also be used either alone or in combination with the ordinary method of producing a blast."

RECENT AMERICAN PATENTS.

[Selected from Mr. Keller's Exemplifications in the *Franklin Journal*.]

IMPROVEMENTS IN CHIMNEY CAPS, FOR VENTILATING APARTMENTS. *Moses Chase.* The following extract and claim, taken from the specification, will give the reader a clear idea of this improvement, viz.:—"As ventilators have heretofore been constructed, they have only served the purpose of discharging the foul air from the apartment, or increasing the draught in a flue by the action of the external current of air near their discharging mouth. By my improvements, I effect, in addition to the result above suggested, the introduction of a current of fresh air from the windward end of the horizontal tube of the ventilator, which greatly facilitates ventilation, and assists, in some degree, the discharging operation from the leeward end of said horizontal tube.

"When my apparatus is used to increase or improve the draught in chimney flues, I carry the descending, or fresh-air tube, down a proper distance in said flues; and I apply to the lower end of the descending tube a reflecting cap, having a cylindrical part larger in diameter than the lower end of said tube, and a conical bottom, which reflects the downward current of fresh air in the tube in a manner which will be readily comprehended."

Claim.—"What I claim, therefore, as my invention, is a ventilator, or chimney cap (with a horizontal turning top), *having a descending flue, or tube, for the introduction of fresh air, opening from the windward end of said horizontal turning top, and passing down through the discharging flue, or tube, and below the bottom of the same, as herein set forth;* the whole arrangement being substantially as hereinbefore specified.

"I also claim the combination of the reflecting cap with the bottom of the descending, or fresh-air tube, the arrangement and purpose of the same being substantially as above set forth."

AN IMPROVEMENT IN PISTONS FOR PUMPS, STEAM ENGINES, &C., CALLED THE "ROLLING, SEGMENTAL, FRICTIONLESS PISTON." *David Hinman.*—This invention consists in substituting for the metallic, or other packing, and the hinged flap, the rolling of metallic or other hard substances on each other, by making the piston of three, four, or more triangular parts, turning on rounded edges along the outer faces of the triangles, the outer faces being made in the form of segments of cones, and rolling on each other when moved together in the same direction—all the segments being jointed to one piston or connecting-rod. The effect of their vibration will be similar to the working of the flap of a bellows.

MACHINE FOR ARRANGING THE BLANKS FOR SCREWS OR PINS, TO DELIVER THEM TO MACHINERY IN WHICH WOOD SCREWS OR PINS ARE TO BE MANUFACTURED. *Solyman Merrick.*

The blanks are thrown promiscuously into a hopper, formed by placing a frustrum of a cone within an inverted frustrum of a hollow cone, the lower edges of the two being placed at such distance apart as to leave a space wide enough to receive the shanks of the blanks, but not the heads; and, therefore, when motion is given to the inner cone, it agitates the blanks, which drop in their places heads up, and carries them around to a slot, where they are delivered in succession, and in a proper position.

AN IMPROVEMENT IN METAL ROOFS. *William Beach.*

The plates are all fluted; one of the side edges of one plate is turned up, and over it laps the edge of the next plate, which is beaded for this purpose; and in this way all the plates forming one range are connected. The upper edge of the lowest range is turned up, to form a ledge, over which laps the turned down edge of the next range, and so on to the upper edge of the roof. And each plate is secured to the wood of the roof by a single nail, that passes through a hole in a protuberance made thereon.

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

(Continued from p. 427).

We come now to the consideration of the laws of motion. Starting from the principle that whatever produces *any*

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alteration in the state of bodies, either as to the velocity or direction of their motion, is capable of being measured and compared with other causes of similar alterations, we see that the subject is one capable of mathematical investigation only so far as this *comparison of the effects* of different forces is concerned. Mathematics has nothing whatever to do with the physical nature of the forces which produce motion, or alter it. If a bar of iron is put in motion by the attraction of a magnet which acts uniformly, and produces a certain velocity in a certain direction after acting during a given time; and if a man, by pulling a string attached to the bar of iron, produces the same velocity in the same direction, and after acting for the same time as the magnet, and does this uniformly—then, so far as the mathematician is concerned, the two cases are absolutely the same. The circumstances to be considered, and the only ones, then are,—1. The quantity of matter put in motion or acted upon; 2. The direction in which the body moves; 3. The velocity of that motion; 4. The time during which these effects are produced.

When we say that one force is *equal* to another, the only meaning is, that the effects produced under the same circumstances are the same for the two forces. In *measuring* a force, we must select some one of these effects: as, for instance, the velocity produced in a given mass in a given direction, and after the force has acted a certain time; and if we notice that, whilst the three latter circumstances, viz. of time, direction, and mass, remain the same, one force produces double the velocity which the other does, then we say one *force* is *double* the other. But if, whilst the mass moved and direction of motion remain the same, we allowed the time to be different in the two cases, we could no longer assert anything as to the relative energies of the forces from the *velocities* produced, inasmuch as two *equal* forces would produce *different* velocities if one were allowed to act longer than the other.

Bearing carefully in mind, then, that the only way in which we can compare one *force* with *another*, is by observing the *different effects* produced (viz. difference of velocity produced, mass moved, time employed, &c.) under *precisely similar conditions* by the two forces, we shall see clearly what is meant by the "measure of a force," and understand how we may have different measures for the same force (*i. e.*, different in their *nature*, not in their degree), according as we select one or other of the various *effects* produced, by which to measure it. For example, the force of the earth's attraction may be measured, either by the velocity which it produces in a certain mass after it has acted upon it during one second (which quantity, estimated in feet per second, is that usually denoted by the letter g (g being $=32{\cdot}2$ nearly), or by the *pressure* which this mass would exert against any obstacle which prevents it from moving. Now, "velocity" and "pressure" are of a totally different nature, and therefore cannot be compared with each other; but if we wished to compare *two forces*, we might select either of these two effects, and compare the *pressure* produced in a body by the one force, with the *pressure* produced in the same body (all the circumstances being supposed the same in the two cases) by the other force; or we might compare the *velocity* produced in one second by one force, with the *velocity* produced by the other in the same time. The beginner requires to be continually reminded of this, simple as it is, namely, that the quantities he meets with in works on the subject, do not and cannot possibly represent the *forces themselves* (the attraction, for instance, of the earth, &c.); but are nothing more or less than *numbers* or *ratios* which denote the *proportion* which the velocity produced by one bears to that produced by another, or which the *pressure* produced by one bears to that produced by another. To say, then, as some have done—and others still more strangely have argued about—that the velocity produced is proportional to the force, is mere tautology, if anything else beyond mere definition is intended.

What are termed the laws of motion are nothing more than the statement of certain self-evident truths concerning force in the abstract—which are necessary as the foundation of a system of mathematical deductions; but before we can *apply* any one of our results to any *actual* case in nature, we must know *what the forces acting are.* The first "law" is, "that a body, if unacted upon

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by any force, will persevere in the same direction, and with the same velocity, for ever." This is the same thing as saying, that if the body *does* change its direction or velocity, some *force* has acted upon it, and this force is capable of being measured. The second law is, that "if several forces act on a body, *each* will produce the same effect as if it acted alone." This law is not given by any two authors in exactly the same terms; the real signification, however, is merely that, if we have any force acting on a body, the presence of other forces does not modify the *force* we are considering; of course, they will modify the *effects* (*i. e.*, the velocity, &c.) of the original force, but will not affect the energy of the force itself.

Considered abstractedly this assertion, that the presence of a new force will not in any way affect the nature and energy of the other force is a mere postulation; which is absolutely necessary, however, before we could take a single step towards calculating the final effect resulting from all the forces. For, if the introduction of fresh forces altered the amount of the others, we should require to know in what way and to what degree such alteration took place. Considered as a physical law, it is altogether untrue in thousands of cases. For instance, a particle of oxygen will attract a particle of iron, but the presence of a particle of carbon, which also would attract the iron, modifies the force exerted by the oxygen. Those experiments which are usually cited in books to prove that this "law" is true, must either be intended to prove it true in every case of physical action, or else are mere illustrations of the meaning of the law. For example, the experiment of a pendulum vibrating in the same time in every azimuth proves simply that the earth's attraction is not altered by its rotation; and so for other such experiments. As a theoretical principle it is nothing else than a "postulate" necessary to be granted before any steps can be taken in the calculation—and as applied to what actually occurs in nature—it is absolutely necessary in every case to know beforehand whether the acting forces do or do not influence each other's energies. If not, we can then find the separate effect produced by each, and combining these determine the final result. As an example, we may take the case of a ball struck at the same time by two different blows in different directions; it is obvious here, that one blow does not influence the *energy* of the other blow, or the *direction* in which it is given; hence the "law" is applicable here, and the resultant motion determined by combining the separate effects of the two blows.

The third law of motion has reference to the *quantity of matter* put in motion by a force. As we have before stated, a force may be *measured* by *any* of its *effects*, either by the *velocity* produced in a given time when the body is free to move, or by the *pressure* produced when motion is prevented by the presence of an obstacle. Suppose a man to pull a mass whose weight is a thousand pounds, and by pulling to give it a velocity; if by pulling uniformly for one second he can give this mass a velocity of 10 feet per second (which 10 feet per second is what is denominated the *Accelerating Force*, in this case), it is obvious, that if he had to exert the same "pull" on another mass weighing *two* thousand pounds, after pulling for one second he would only give it a velocity of *five* feet per second. Taking it for granted, for the present, that weight varies, or is proportional to the *quantity of matter*, we see that the *same force* when employed on *different masses* produces in the same time, *velocities* as much *less* as the *masses* are *greater*. Again: suppose that a man by pulling at a mass weighing one pound for the space of one second, it gives a velocity of ten feet per second, and another equal mass being added to the former, and he gives to this one also by pulling for one second the same velocity as the former—if now an obstacle be placed in the way of the mass of matter (weighing 2 lbs.) the *pressure* against this obstacle will be double what it would be when the mass acted upon was only one of the masses (in all these illustrations the masses are supposed to lie on a horizontal plane, and the string by which the pull is made to be also horizontal, so that the *weight* of the bodies does not affect the question in any other way than as being indicative of the *quantity of matter* moved). If the pressure exerted by the single mass, *tending* to go on with a certain velocity, be 10 lbs., that exerted by the double mass, *tending* to go on with *the same* velocity, will

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be *twenty* pounds. The velocity which would be produced in a body, if the force acted on it uniformly be for one second, is the "*Accelerating Force*." This being the same for the two masses in the case supposed, we see that the *pressure* is *proportional* to the *mass* or *quantity of matter* moved, when the "Accelerating Force" remains the same. Again: let the pressure exerted against an obstacle by the mass in the preceding case be as before ten pounds; if the man increase his pull, so as that, if free, the mass would at the end of the pull (lasting one second as before) have a velocity of *twenty* feet per second, *i. e.*, double the former—then it is equally obvious that the *pressure* will also be *doubled*. The accelerating force being, as we have said, the velocity produced in one second, the *accelerating force* being *doubled*, and the mass, or quantity of matter moved, remaining the same, we see that the *pressure* is doubled. Hence, if, the accelerating force remaining the same, we increase the *mass* in any ratio, just in the same ratio do we increase the *pressure* which would be exerted against any obstacle stopping the body; or, if we increase the *accelerating force* in any ratio, leaving the *mass* acted upon unaltered, just in *the same ratio* do we increase the pressure. Therefore, if *both* the *mass moved* and the *accelerating force* be *doubled*, the *pressure* will be *quadrupled*, and so on; in short, the pressure varies as the product of the mass moved and the accelerating force—which is the 3rd law of motion. If P denote the pressure, M the mass moved, and f the accelerating force, then P is always *proportional to* M f.

(*To be continued.*)

THE "COLLEGE OF PRECEPTORS."

(Concluded from page 563.)

The objects of the members of the original college of schoolmasters, in Brighton, was to raise by a fictitious system of pretension, the character of their respective schools, and to maintain the "London connection" against the aggressions of the interloping "new proprietary college." This, we believe to be still the object. That college, however, is not likely long to stand in their way: for, from the outset it promises to verify the predictions which (founded on the analogy furnished by the history of similar institutions) we have over and over expressed, as the inevitable fate of all such schemes in connection with education. After canvassing in all directions and with desperate energy for a year and a half, it opened with *fifty* pupils, instead of the anticipated *minimum* number of *two hundred!* The presentation-shares, however, of forty pounds each, brought money into their exchequer; and, as usual, with men unaccustomed to the previous possession of money, it is lavished in the most absurd manner in the shape of salaries to the masters. It may be politic to give a bonus in such a shape to the masters, to ensure their honest and their best exertions to establish the character of the school as a place of education; but we think that such salaries would have commanded tried and experienced men, instead of a few unfledged teachers whose highest recommendation was, that they had mounted the "bachelors' white fur." Even their "principal*" has not yet taken his *master's degree!* Are the Brighton people moon-struck? What *can* come out of a scheme so worked? We shall see.

One of the great mistakes of the "College of Preceptors" consists in the supposition that an act of parliament or a royal charter can give a social status to a body of men, irrespective of their original and professional status in the eyes of society. Such an act, or such a charter would not in the slightest degree elevate the present members above their present position. All it could do, were it properly and honestly worked out, would be to prevent unqualified persons from officiating as teachers: but as a class they would still hold the precise position which they now do in public estimation. As individuals they would be personally respected as they now are amongst their friends, for their personal qualities: but no social respect on the mere account of their profession, would ever accrue from their incorporation. Yet this is what they hanker after; and to querulous complaints of the want of

* Mr. Maclean, however wanting in age, in station, and in experience, is yet supplied with a full share of that *amour propre* which belongs to a great man,—as is verified by such a remark as this:

"The 'College of Preceptors' are, I dare say, a very respectable set of persons: but they must be sacrificed to the public good." That is, their schools must be emptied for the benefit of the speculation by which he is himself maintained!

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this social rise in the scale they mainly confine themselves. If eminent scholars, they will be personally and socially respected: if not, their present scheme must fail to supply their lack of learning. As a body no *prestige* can ever attach to them: for *prestige* flows from antiquity alone; and the tendency of the present age is more to the destruction than to the creation of this class of influences.

Whatever be the views of the rest of the "Council," it is very clear that their Secretary is "wide awake;" and that he entertains views of his own of a far more practical kind. To say the least, he must see in the ostensible scheme a degree of risk that would scarcely have justified him in giving up his school in Brighton, however limited his "patronage" there might have been, for any chances of a successful working of this college on its proposed plan. Many schoolmasters might have paid their first guinea at some inconvenience, under the prospect of obtaining the *quid pro quo* in the shape of more pupils or greater publicity. Of course, in such calculations those persons would be mistaken; and a goodly number of them will fall off in the second, and more still in the third, years' payments. Those who kept aloof at first are little likely to come forward hereafter, when they see the inefficacy of the project, both as regards their own interests and the public benefit. This could not escape the shrewd Secretary, as at least a possible, and by no means an improbable, contingency. "Taking time by the forelock," he provides against the pecuniary effects of such a check, by *the direct conversion of the college into a trading company*. A SCHOOLMASTERS' ASSURANCE COMPANY AND A SCHOOL-REGISTRY OFFICE! Such has the "College of Preceptors," which was to *purify* the scholastic profession from ignorance, quackery, and selfishness, become in one single year!

We have no objection to the establishment either of a schoolmasters' insurance company, or a school registry office, in themselves. Yet for a body of men to band themselves together for a purpose which seeks the sympathy of the philanthropist, and professes to exclude all considerations connected with personal gain, so soon to commence the gross and outward worship of *mammon*, does appear to us a very bold attack upon public credulity. Let the college be made the pretence for obtaining a charter which shall include these two objects; and then the professed purposes of the college will be thrown overboard. This adroit scheme for procuring the incorporation of a trading company at the expense of the simpletons who subscribe their guineas, will be hereafter quoted as a singularly clever piece of commercial *finesse*. If the college wish to maintain the high character for which it puts forth such vociferous claims, it should hold itself perfectly aloof from all schemes which may be productive of pecuniary gain; and we are much mistaken if some of its more chivalrous and disinterested members do not publicly condemn this part of the developed scheme, in a more effective form than by remonstrances in the council-room of Great Russell-street. We shall be much surprised, indeed, if those noblemen and gentlemen who have given their names as "PATRONS" of the scheme, viewed as an educational one, when they see it so early converted into a mere trading company, do not regret their hasty patronage. But patronage of anything which *professes to be education*, is, in these days, a peg upon which to hang a political crotchet, and a favourable chance for parliamentary men to gain, without trouble, a character for popular principles. Unhappily "the people" have more to dread from friends like these than from their open and decided opponents. Yet we think that even the published patrons of the "College of Preceptors" (albeit, some of them are little celebrated for either profound wisdom or personal liberality) will begin to see that they have ventured a step too far. They may, indeed, be far-seeing enough—a *very far* sight is not required—to discover the wisdom of retracing a few of the steps they have taken, *pari passu*, with the "College of Preceptors."

If, however, Mr. Parker's scheme of the insurance and registration shall be successful as a commercial one, he will have made for himself a snug berth, far better than school-keeping. We shall not regret this in itself; but we shall regret the shameful prostitution of those high and chivalrous principles, which the college originally professed, to so mean a purpose as the provision of a livelihood for one man and his *protégés*.

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We think, looking at this part of the scheme as a matter of mere business, that there is room for both the company and the registration office; and we only object to its being the unhallowed adjunct of a society that repudiates all selfish considerations. We wish above all to show that, clever a financier as Mr. Parker may be, the "College of Preceptors" has *disentitled itself to the confidence of the public in its educational pretensions and movements.* We wish, moreover, to be fully understood as condemning in the strongest terms the attempt to procure a royal charter for mere commercial purposes, under a pretence of bettering "the education of the middle classes," or of any class whatever. Let the *real objects* of these men be declared —and then let them get their charter on the best terms they can.

We have nothing to say to the personal disparagement of Mr. Parker, or any of his Council; and it is solely in reference to their pretensions as *public men*, and as the originators of a society which appeals to public sympathy for its public objects, that we have commented upon their movements. Their private characters, we dare say, one and all, stand high; and even had this not been the case, it would have been immaterial—for it is only to public acts and professions that the journalist is usually justified in referring.

The preposterous addendum to the college of a "Ladies' Department," seems to us to savour more of "twaddle" than any other part of the scheme. For what class of "ladies" this boon is intended we know not; for upon this point the oracle is silent. We should suppose, however, that this aspiring body will fly at the highest game; for in this case they have no university degrees to compete with, nor university *prestige* to stand in the way of their ambition. Of the authentic business of such schools, or the particular class of qualifications which are required in them, these learned pedagogues are but little cognizant: and, indeed, as the guineas, and the insurance and registration business which it will bring, are the main objects of the collegiate body, any especial degree of knowledge of this kind would be a superfluous incumbrance. Let these gentlemen amateurs (or gentlemen dealers) in feminine acquirements, first acquaint themselves with the general *parental objects* of a daughter's education, and the consequent materials of which it is composed. Let them begin by reforming *maternal* judgment on these matters, so as to allow at least a *chance* for the intellectual governess to earn her daily bread. "Accomplishments," however, furnish the general recommendation to public support; and till the public judgment as regards the objects of woman's education is considerably changed, we can only look upon this scheme of Messrs. Turrell, Parker, and Company, of establishing "A Ladies' College," as something akin either to imposture or hallucination. Such a desirable state of things does indeed appear to have made its beginning; still it is on so limited a scale that a judicious scheme of feminine education has yet been tried, that years— yes, many years—must elapse before any steps towards organization can safely, or prudently, be taken. In the present state of things, the attempt is characteristic of presumption, ignorance, and charlatanism.

Another specimen of the towering ambition of the Brighton pedagogues should be noticed. Mr. Wharton tells us (*vide* letter of 22nd February, 1847), that "the publishing committee will proceed *to take measures for the production of such works as the wants of education most urgently demand.*" Be it observed, for the "*production*," not for the *selection* of suitable scholastic works, is the term employed; thereby declaring that suitable works for the purposes of education, either in science or literature, *do not at present exist.* This is a sweeping assertion, made by the most able member of the council; and it is adopted, also, in the organ of the college (*vide* "Calendar," p. 103) as a strong ground for the formation of the company. These gentlemen, however, as far as we can learn, are guiltless of any contribution to the "arbitrary devices* and incongruous productions which now bear the names of school-books." They have reserved their strength for one grand effort in combination. They have hitherto hidden their light under the bushel, that they may dazzle modern England with their brilliancy by its sudden display in the midst of the Egyptian darkness on all educational

* Mr. Turrell's letter of April 24th, 1847.

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subjects in which we are enshrouded. We await with some amount of terror for their effects upon our optical faculties, the appearance of Mr. Turrell's English Grammar—Mr. Parker's Commercial Arithmetic—Mr. Wharton's Course of Mathematics, carrying out the splendid conceptions of his "*test*," (*ante* p. 560)—Dr. Wilson's Book of Collegiate School Themes—the Latin, French, and Italian Grammars and Phrase-books—and the profound treatises on History, Geography, Botany, Natural Philosophy with which the "M.C.P.s" have promised to overwhelm us. We trust due notice of publication will be given, that we may be prepared with our "smoked glasses" for the occasion. But, in all seriousness, we have never before met with such an extraordinary instance of self-sufficient impertinence in a body of sane men; although we might have witnessed something analogous in cases where sundry of her majesty's liege subjects are "taken care of by their friends," or by the parish, or by the county. There is no immethodical madness, however, in the present case, great as the vanity of these pedagogues may be. They "know what they are driving at," albeit they may have somewhat miscalculated the distensibility of the public stomach. This they will learn in time: they have made a great experiment upon public credulity, and time alone can show them how far they have anticipated the correct result.

It would ill become us to say, that these gentlemen are incompetent to the task they have presumed to undertake, in the absence of all evidence arising out of the productions which have emanated from their fertile minds. Either our old friend Joe Miller, or somebody else, tells us of a gentleman who was questioned as to whether he "could play the fiddle?" and he *naïvely* replied, he "didn't know, for he had never tried!" As far as we can learn, the "College of Preceptors" is in nearly the same condition as Joe's *naïve* friend — they have "never tried," or, at least, have never *tried in public*. They may, therefore, after all, prove themselves the "Titans" amongst school-book manufacturers. For the development of their genius in this branch of patriotism, we must wait their own time and their own pleasure. Certain of their writings are, however, before us, —their circulars, their letters, their advertisements, and, last of all, their "Calendar." We have occasionally referred to these already, but only to verify our assertions respecting the objects of the managers, not to examine their literary merits. So much of our space (which we could ill afford, and should not have afforded at all, but from our conviction of the pernicious tendency of the recent movements of the college) has been already occupied with this college, that we must bring it to a close with only a slight notice of the contents of the "Calendar."

We are puzzled, at the very outset, to discover by whom this "Calendar" has been edited. Is it by the Council, a Committee deputed by the Council, by an individual member, or by the Secretary in his official capacity? We should be glad to know: for we have heard so many singular statements respecting this immortal work, that even as a matter of literary curiosity, the question possesses some interest. In *form*, at all events, this work is the work of the Council, with an *approved* "prefatory notice" from the pen of the Secretary, with his official signature appended. By whomsoever written, the preface itself is characteristic of the most extraordinary heroism—in its *defiance of all the trammels of art:* there is scarcely a sentence, even in the course of little more than a single page, which does not violate one or other of the most familiar canons of English grammar or English composition! Such is the opening: and we shall find other charges equally grave to lie against nearly the whole of the book. The acknowledged extract from the paper read by Mr. Parker at Brighton, (which it is boastfully affirmed "first gave consistency to this movement") is strikingly marked by its inflated, declamatory style. It is the mere stringing of epithets and phrases into "sound and fury, signifying nothing." It is full of the worst faults of juvenility in composition, yet wanting in all those brilliant passages which so often give peculiar beauty to the efforts of the young: the baldness in the style, the meanness of the conceptions, the unrefined choice of terms, the inconsecutiveness of the ideas heaped together—all these peculiarly betray the unlettered taste which governed the composition of every line. Yet

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this is the *polished* edition, which has taken a year and a half of furbishing up to meet the tastes and circumstances of more recent times; and, moreover, a selected "tit-bit," peculiarly adapted to display Mr. Parker to advantage as the literary *chef de cuisine* to the "College of Preceptors!"*

But in first approaching that unapproachable effulgence, "the Inaugural Address by the Senior Moderator, the Rev. R. Wilson, D.D.," we were so perfectly confounded, that we closed our eyes in despair of ever penetrating the purpose or meaning of this "dark-with-excessive-light" phenomenon. We have, however, tried again and again; and practice strengthens the eyes as well as the other common-place functions of our common nature. We have learnt to view it at all distances, and from all points of sight—we have looked at it from without and from within—and we confess we are not too old to have learnt a useful lesson from it. In early life we have been startled by mistaking the phantasmagoria for a ghost; in later life we have seen a brighter glitter on the tinsel than on the purest gold; we have often heard stage-thunder, and witnessed theatrical coruscations more frightful (or as we have heard it termed, "more natural") than the war of the elements of nature; we have seen the most perfect saint a confessed sinner; and the most maligned and execrated of our species proved to be free from the crime, the belief of which has made him an outcast:—but we never before witnessed a mere *vulgar school theme* dressed up in the magnificent verbosity of Jeremy Taylor, and delivered with the dignified pomp of an Orator Henley, that at all approached to the virtues of this "Inaugural Address!" Analysis, even with the aid of the doctor's list of "topics," of this singular piece of rant and fustian is impossible; or, at least, it transcends our humble capability. We have, indeed, extracts from a dozen theme-exercises hustled together:—we have relationships between the "College of Preceptors" and the most heterogeneous collection of historical personages of classical and of holy writ: we have mixtures of all the styles of our language, from the bald to the plethoric, mixed up with scraps of Latin, and ridiculous constructive imitations of the Greek: we have, in short, an indescribable and purposeless "hotch-potch" of the grand and the mean—of discreditable ignorance and of easily "got-up" learning—of silly conceits and inapplicable similitudes—of common-place quotations and original incomprehensibility! That this "address" should have been so flatteringly received, and so rapturously applauded on its delivery, only tells us too well the character of the audience; and the audience itself is thus shown to have been of the kind that the occasion was most likely to draw together, and thus verifying the nursery dogma respecting "birds of a feather." One quotation, however, of our pompous "Senior Moderator" deserves notice. He says, "It has long been an adage with us:

> "'A little learning is a dangerous thing,
> Drink deep, or taste not the Pierian spring.
> A little draught intoxicates the brain,
> But drinking deeper sobers it again.'"

We trust that in the interval between the delivery of his first address and the "coming off" of the farce of next week, the learned doctor will have devoted himself to "midnight potations, strong, deep, and oft"—at least sufficient to sober down the etherial rhodomontade of this strange address. We are "in sober sooth" sorry to see a man, of whom his university-friends augured well (for he was a Cambridge wrangler!), so far demeaning himself under the incense of the flattery administered by the Brighton school-faction, as to utter and to print so many pages of such arrant nonsense—so arrant, indeed, that a single one of them would condemn a man of respectable talent to irredeemable exclusion from literary reputation!

There is also another gentleman who figures in the "Calendar," Mr. Wharton. This gentleman was second "Senior optime" of his year (1829); and we

* What a mass of wonderful composition we have lost by Mr. Parker's modest suppression of the whole discourse. Producing the thrill that it did in the breasts of the Brighton philosophers, congregating at the "Albion Hotel and Tavern," he might have inferred that, it would electrify all England by induction. How ungrateful of the Albion Club not to *insist* upon its publication: but we suppose there might have been a touch of jealousy rankling in the bosoms of some of the other gentlemen who "wanted a finger in the pie," and whose subsequent mission would have been rendered unnecessary by the publication of Mr. Parker's entire publication. Alas! poor human nature!

are in justice bound to say, that though somewhat injudiciously earnest in his proceedings, and not very careful in contemplating the possible results of his measures, he is yet the man of far the highest mark that has busied himself with Mr. Parker's notable scheme of education. Whatever may be said of his views, he is at least a fair scholar, and a scholar whose acquirements appear upon the face of his writings to be considerably varied. We have no ground to question the solidity of Mr. Wharton's *literary* attainments, however much his previously quoted "test" bespeaks his having left his mathematics behind him in the senate-house some eighteen years ago. This might, indeed, have been somewhat more intelligible to us had his name appeared in the "Classical Tripos" of his year; but we admit Mr. Wharton's own talents and attainments to be such as to entitle his opinions on educational subjects to some attention, and occasionally to respect. We regret the more to see such a man rendering himself the willing tool of a small faction of the schoolmasters of the south of England.

A grand semi-annual gathering of the "Collegians" takes place next week. They will speechify to one another, and palaver over their "after-dinner" libations. They will examine candidates, and grant diplomas—and the Rev. Dr. Wilson will treat them to another of his orations. A new president will be elected; Mr. Parker will have his "check signed;" the editor of the *Mechanics' Magazine* will be "roundly rated;" and the antique juveniles will respectively depart upon their "professional tours," in the full anticipation of a few venal journals having trumpeted their fame to the ends of the earth.

Thus will commence another year of the College:—but how will the year terminate? In *reform*—in *extinction*—or in *triumph?* Schoolmasters of England, it rests with you to answer!

TELEGRAPHIC CONVEYANCE OF INTELLIGENCE BY LAMPS AND FLAGS.

Sir,—By a letter in No. 1243 of the *Mechanics' Magazine*, I see that some person has invented what he calls a *novel* plan of conveying intelligence with lamps and flags.

I beg leave to inform your correspondent, that although the *particular plan* which he proposes *is new*, yet that the *general principle* of representing the alphabet by compound signals, and a particular plan, based thereon, of conveying intelligence by lamps and flags, and needles of electric telegraphs, *is not new*, but was invented upwards of six years ago. I do not consider that there is any particular *merit* in the invention of these compound signal alphabets, but what little of merit there is attached to them belongs to me, as it is well known that I am the inventor of them.

Even Mr. Cooke himself, the patentee of the electric telegraph, when I suggested the system to him six years ago, told me that I must be insane to suppose that I could convey general intelligence with less than 24 simple signals.

All those compound signal alphabets, which I have hitherto seen, are evidently nothing more than *imperfect* copies of the system which I invented for the Blackwall Railway, and which system has been in daily use on the Blackwall Railway, privately since the autumn of the year 1840, and publicly since the overflowing of the Thames, which I think occurred in 1840.

There are two parts to the system; one I call the public signals, which consists merely of a common alphabet represented by compound signals, and which is very well for novices; and the other I call the private signals, which consists of groups and series of compound signals *having relation to time*, and a peculiar telegraphic language which has never yet been made public. This part of the system is partly analogous to music, partly analogous to the principles of short-hand writing, and partly analogous to the *universal* principles of language. One individual could never bring the system to perfection; but probably a general idea of it will be published when Messrs. Cooke and Wheatstone's telegraph becomes public property.

The system is applicable for conveying intelligence by lamps, or flags, or needles of electric telegraphs, or any other kinds of materials, provided there exists two or more distinguishable fundamental elements; and the system is so pliable that it could be used with telegraphs of one needle—telegraphs of two needles—three needles—four needles—or any other number of needles. The only

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difference being, that the greater the number of needles, or lamps, or flags, &c., which is employed, the more rapid is the transmission of intelligence. So that by my universal system of telegraphic correspondence, telegraphs of one needle may be applied to very long distances, such as oceanic telegraphs—telegraphs of two needles to moderate distances—and telegraphs of six needles to very short distances. I spoke also on this subject to Mr. Cooke, six years ago.

But with respect to your correspondent's signals, I do not claim the invention of the *particular* signals suggested by him; I only wish it to be understood, that the general principle of conveying intelligence by means of two or more simple signals, combined in groups, and given by magnetic needles, or by coloured lights and flags, or by any other two or more distinguishable things, *is not new*, but upwards of six years old.

With respect to the plan, suggested by your correspondent, for preventing accidents to the passengers inside the carriages of moving trains, I beg leave to say, that I know of an instrument which, if *rendered perfect*, would answer the purpose desired by your correspondent. It is Mr. Cooke's *train alarum.*

Mr. Cooke's plan of forming a communication between the carriages and engine of a train, by means of insulated wires, is *very good*, but it wants an infallible alarum to render the system perfect. Mr. Cooke's alarum is extremely fallible; and a fallible alarum is worse than none at all, inasmuch as it deceives both the giver and the receiver of the signals—gets both into trouble—and increases the danger to the public.

I am, Sir, yours, &c.,
GEORGE PETRIE.

Telegraph, Blackwall Railway,
June 12, 1847.

MR. BAIN'S NEW SYSTEM OF ELECTRO-TELEGRAPHIC COMMUNICATION.

[Patent dated Dec. 12, 1846. Specification enrolled June 12, 1847.]

We mentioned some time ago that Mr. Bain had patented a new system of electro-telegraphic communication, which promised to exceed in rapidity all that had been previously invented, either by himself or others. The specification of it has just been enrolled, and the following is a correct abstract of its contents:

Mr. Bain states, that his present improvements have for their first and main object, to obviate the waste of time which now attends the making and breaking of contact by means of electro-magnets, and the employment of needles to indicate the letters of the alphabet, figures, &c. He describes various arrangements by which this may be effected, but they are all nearly similar in their general features—at least in so far as respects their elementary principles, and the effects produced by them. (To give a distinct and clear view, however, of this specification, we are forced to depart somewhat from the order in which the various parts, &c., are described in the original.)

Each complete system of arrangements consists of course of a transmitting apparatus at one end of a line, and a recipient apparatus at the other, with a connecting wire, or wires, between them. Figure 1 is an elevation, and fig. 2 a plan of so much of a transmitting apparatus as is necessary to show its mode of action. A A is a thin roller of wood, upon which there is wound a long strip of paper, which has been previously perforated with holes *a, a, a,* in the manner represented in fig. 3. Each group of holes, as divided by the cross lines, represents some one or other of the letters of the alphabet, or some one or other of the usual numerals, or entire words or sentences, according as may previously be determined upon. From the roller A, the end of this slip of paper is passed between the roller B and two metallic springs C^1 C^2. The roller B is composed of metal pieces a^1 a^2, mounted upon wood inside, so that their two contiguous edges shall be some distance apart. Motion is communicated to this roller from clock-work, which is regulated as to its velocity by means of a ball-governor instead of a pendulum. The recipient apparatus at the opposite end of the line, is in all respects the same as the transmitting one, except that instead of the strip of perforated paper, there is wound upon the roller A A a strip of coloured paper, which has been first soaked in dilute sulphuric acid, and afterwards in a solution of prussiate of potash; and is so wound upon the roller A, while yet in a wet or damp state (in which state it forms a part of the voltaic circuit, and must therefore be

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Fig. 1.

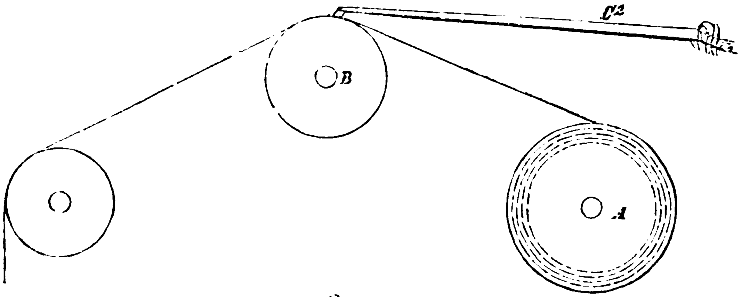


Fig. 2.

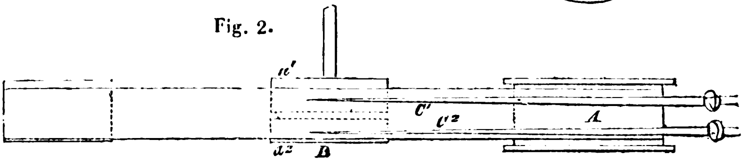
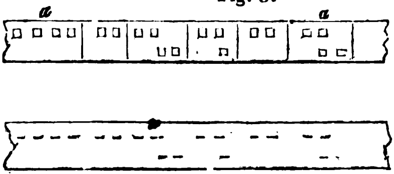
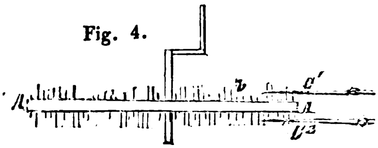


Fig. 3.



L O N D O N

Fig. 4.



kept while the communication is being transmitted). Matters being thus arranged, and the machines at both ends of the line being placed in metallic contact by means of a single wire passing between them, and the metallic springs C^1 C^2 being connected to a galvanic battery, the attendant on the transmitting apparatus sets it going, which has the immediate effect of lifting a detent in the recipient apparatus at the other end of the line, and thereby setting that going also—that is to say, the two machines commence unrolling simultaneously the strips of paper attached to them respectively. As long as contact is prevented between the springs C^1 C^2, and the roller B of the transmitting apparatus, by the interposition between them of the entire parts of the roll of paper, the passage of the voltaic circuit is interrupted or broken; but the instant that either of the springs C^1 or C^2 comes over one, two, or more of the holes in the paper, the voltaic circuit is re-established, and the electric current flowing through these holes passes along the connecting wire and through the wet roll of paper of the recipient apparatus, discharging in its passage the colour from the paper (by the decomposition of the chemical substances employed in its preparation) in those parts which it penetrates, and thereby leaving as many legible spots on the wet roll of paper as there are holes in the dry. It follows, that by thus alternately breaking and renewing contact, and that as fast as this can be done, strokes or dots, corresponding to letters, numerals, &c., can be made on the recipient strip of paper.

An exemplification of the alphabetical characters Mr. Bain employs is given in fig. 3, which represents at once the perforations which would be made in the transmitting paper, and the corresponding marks which would be made inth e coloured or recipient paper, to express the word *L O N D O N*.

When it is desirable that the attendant

of the machine should not know the contents of the communication made, the recipient paper is to be wetted with dilute sulphuric acid, and then passed through the apparatus in the manner above described, after which the words can be rendered legible by immersing the paper in a solution of prussiate of potash.

Among various modifications of the preceding arrangements specified by Mr. Bain, the most noticeable is one in which a revolving disc is employed, in the periphery of which there are a number of metallic rods, or wires, of equal length, which may be made to slide out towards one side of the disc, or to the other, at pleasure. Fig. 4 is a plan of this modification. A is the edge of the disc; *b b* the wires; and C^1 C^2 springs similar to those marked with the same letters in the other figures. It will be obvious that when the disc A is made to rotate, the springs, C^1 C^2 will successively be brought in contact with the wires *b b*, on the one side or on the other; and that as they are made the means of establishing the metallic connection between the two ends of the line of communication, the effects produced upon chemical decomposable substances will be the same as before described. In this case the wires *b b* serve the purpose of the holes in the strip of paper, fig. 3.

Mr. Bain describes, finally, an improved method of constructing the posts for supporting the wire of communication. He proposes to make each post of several pieces of wood bound together by cast-iron hoops, intending thereby (apparently) to lessen the chance of the wires being affected from beneath by disturbing currents of electricity.

[From the description given of Mr. Bain's invention, it will be seen that the rapidity of communication by it, is limited by two circumstances only,—first, the time required to punch out the holes in the roll of paper of the transmitting apparatus before committing it to (may we not say?) the press, and, second, the number of intermissions of the electric current which can be effected in any given time—one intermission being requisite for every letter, or sign. Now, the time required for the first part of the process, must depend on the number of letters or signs which it is in the physical power of a clever hand to punch out in a given time, which can scarcely exceed, on the average, 100 a minute; but the passage of the electric fluid is so instantaneous (faster than lightning) that we make no doubt from 500 to 1000 intermissions in a minute may be readily effected in the way proposed by Mr. Bain. Supposing, therefore, a communication to be once punched out in paper, and the paper to be committed to the transmitting apparatus, it will require but a few minutes to convey that communication to any distance, however great, and that, too, in as complete a state as any letter, despatch, circular, or pamphlet is now conveyed bodily by post. We foresee the perfect practicability in this way of all the leading articles of the *Times* (*ex. gr.*) being reprinted and republished in Liverpool, or Glasgow, or Edinburgh, simultaneously with their publication in London! It would only be necessary, in order to effect this incomparable desideratum, that there should be placed by the side of each compositor a man with a set of punches and a roll of paper, to punch as fast as the other composed—and that, when a column was completed, it should be sent off to the Electric Telegraph-office, to be transmitted to Liverpool, Glasgow, or Edinburgh, there to be rendered from the telegraphic characters into the ordinary characters of our mother tongue, reprinted and republished. Has any other plan of electro-telegraphic communication yet proposed offered advantages equal to this? We believe not. Suggestions, pointing to such a plan, have, we are aware, been thrown out before now; but Mr. Bain has, at all events, the unquestionable merit of being the first to turn to practical account a principle which all the other able men occupied with the same subject have practically neglected. Ed. M. M.]

COMPARATIVE STATEMENTS OF THE MERITS OF COOKE AND WHEATSTONE'S DOUBLE NEEDLE TELEGRAPH AND BRETT'S ELECTRIC PRINTING TELEGRAPH. BY MR. W. H. FRENCH.

(Continued from page 466.)

The 13*th Objection* to Cooke and Wheatstone's system is, the liability of even the most proficient recipient to mistake one

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letter for another, through the sticking of the needles, or from an error in counting their deflections; as for example, SHE for THE, WISH for WITH, FEW for G*EW, &c.

With Brett's telegraph, the letter which appears at one end is shown at the other in duplicate, and in a printed form, so that similar mistakes cannot occur.

The 14*th Objection* is, the probability of the whole sense of the communication being changed by wrong punctuation; as, for instance, "What! do you know," for, "What do you know?"

By Brett's system, the composition is stopped, spaced, and justified, like the pages of a book.

The 15*th Objection* is, the limited distance to which communications can be transmitted by an unbroken circuit, the greatest hitherto accomplished being 120 miles, and even this short distance cannot always be depended on, in consequence of the loss, fluctuation, and unnecessary expenditure of battery power; or the formation of a double circuit, or of imperfect insulation and other liabilities of contact, and want of contact in the wires.

In my last communication I said, that Brett's telegraph had been proved to act with certainty in continuous lines of 230 and 340 miles. I have since then seen a letter from a highly respectable firm in New York to a gentleman in London, whose high position for many years in two of the first establishments in the kingdom, places the following statement beyond a doubt: "First, as to the greatest distance an electric shock has been sent sufficient to work the escapement, I answer it has been conclusively proved for 900 miles, and there is no reason to doubt but an escapement may be worked from New York to New Orleans. My opinion decidedly is, if you can get a Company's line to establish it upon, you had better at once send for Professor House and have it done throughout under his direction, and he will guarantee its working (which I have not a doubt will be to your, and your friend's satisfaction) all he has represented. A child may work it, to such perfection has he brought it." The result will not then be doubtful but certain.

The 16*th Objection* to the use of Cooke and Wheatstone's telegraphs is, that when disconnected, they can only be re-connected by persons well acquainted with the connections; and even then, will be attended with uncertainty and delay, by reason of the distance existing between each instrument. The loss of time principally arises from being obliged to travel from instrument to instrument to test the connections of each —it being necessary to connect the first instrument of each series differently to all the others. Thus, No. 1 line wire should be connected to the left-hand springs leading to one end of the coil of stop + E needle, and to the earth to the other end of the coil-wire: No. 2 line-wire and its earth-wire should be connected in like manner to the springs and coil of the H N needle. All the intermediate instruments should be connected in the reverse manner; thus, the up portion of No. 1 line-wire, leading from the left-hand springs of the first instrument, should be connected to that end of the coil, which, in the first instrument, is connected to the earth-wire; the down portion of the same No. 1 line-wire should be connected to the springs leading to the other end of the coil. The up and down portions of No. 2 line-wire should be connected in the same manner to the coil and springs of H N needle (no earth-wire being used at intermediate instruments). The last instrument of each series should be connected in the same manner as intermediate instruments, with the exception of the earth-wires being connected in place of the down-wires, *i. e,* to the springs; by which means the circuit will be completed through the earth. In consequence of the liability of the above arrangements being reversed, for the want of a given rule in connecting the first instruments of each series, I have known whole weeks wasted by persons supposed to be acquainted with the connections, and with no better result than receiving E + NH (or some such cross movements), in answer to the signals given for testing the connections, namely, + EHN, which, if the connections were right, would be repeated.

If Brett's telegraphs should become disconnected, they may be re-connected by a child, with certainty; without occasioning the least delay—as it does not matter how they are connected,—whether the earth or line-wire is connected to this or that portion of the terminal machines,—whether the up or down portion of the wire is connected to this or that portion of the intermediate machines, or whether the terminal or intermediate machines are connected reversely or alike. The very moment the machines are connected, they are ready for action, and need not be tested.

17*th Objection* is, the liability to mistake the up for the down portion of either wire,

* G the substitute for J.

which is of frequent occurrence, from the want of a judicious arrangement of the wires, and from their being taken wrongly into the stations. The tracing of the wires, is invariably attended with difficulty and delay. The evil of using two wires as the channel of galvanic influence for the entire indication of the alphabet, may be seen by No. 1 wire being connected to the coil of + E needle of some instruments, and to the coil of H N needle of other instruments; consequently, the needles of + E coil will be deflected on some of the instruments, and the needles of H N coil on others, whereas only one or other of the needles were intended to be deflected on all the instruments.

Brett's telegraph having but one wire, there is no fear of not printing and indicating the entire alphabet, or of one letter being printed and indicated for another, from any misdirected impetus being given to one or other portion of the mechanical arrangements, the whole being influenced through the same channel, viz., one wire.

18*th Objection* is, the absolute necessity of maintaining an uniform connection of the poles of the battery; for, if the positive pole were connected in place of the negative pole, and *vice versâ*, the needles would be deflected to the right instead of to the left, and to the left instead of to the right.

In Brett's telegraph, it does not matter how the battery is connected,—whether it gives off a positive or a negative current, or whether the fluid flows in this or that direction. The action will be the same, of which there will be a progressive uniformity in each machine, because, as I before said, the mechanical movement cannot retrograde.

19*th Objection* is, since the introduction of the letters Q and Z (see alterations made by the Electric Telegraph Company, p. 400), the necessity of using two series of batteries of great intensity* for completing one series of instruments; thus doubly increasing the expenditure of electricity and variation in the electro-magnetic deflection of the needles, as the beat of one needle will, most likely, differ from the other, it being difficult to keep both series of batteries of the same intensity.

Brett's telegraph requires only one series of batteries to each series of instruments, and but a small amount of electric power to give the first impetus, which is all that is required for starting each machine. A sufficiency of electricity can be obtained from an almost exhausted battery to ensure an uniform action of mechanical and hydrostatic or pneumatic power. W. H. F.

(*To be continued.*)

* An almost exhausted battery will frequently deflect the needles strongly when the circuit is first formed, but will neither keep them deflected, nor produce other deflections by the immediate formation of any subsequent circuits.

MR. JACOB BRETT'S ELECTRIC TELEGRAPH.

Sir,—The object of my communication of May 19, to which you accorded a place in your valuable Magazine, was not the development of a controversy, but the establishment of the truth.

Mr. French, in his first communication, positively asserted that Messrs. Cooke and Wheatstone *could not work a telegraph with a single wire.* He has now, in his answer to my letter, contradicted his former assertion, and admitted that they *can do so.*

He has evaded any explanation of his declaration, that Mr. Brett *has* transmitted 87 letters, and *can* transmit from 300 to 3000 letters per minute.

In the first paragraph of the letter purporting to have been sent to Sir R. Peel, a glaring anachronism is allowed; Mr. Brett being there represented as stating, in July, 1845, that he *had already secured a patent for his invention*, whereas his patent is not dated until *four months after that time.*

Finally, Mr. French asserted, that "4000 miles of this (Brett's) telegraph have been completed in America." The *Herald for Europe*, published in New York on May 15, 1847, denies, in the most emphatic manner, that *any telegraph, excepting that of Professor Morse, is at present in use in the United States.*

With these facts before me, I do not feel inclined to trouble Mr. French for any additional information.

I am, Sir, yours, &c.,
TYRO ELECTRICUS.

London, June 9, 1847.

ELECTRO-TELEGRAPH INTERRUPTED BY ATMOSPHERIC ELECTRICITY.

[Extract of a letter from M. Breguet to M. Arago. Translated for the *Mechanics' Magazine.*]

About five o'clock in the afternoon, during a heavy fall of rain, the bells of the electric telegraph (placed in a little shed, at one end of the St. Germain's Atmospheric Railway) began to ring, which led the attendant to suppose, that he was about to receive a communication. Several letters then made their appearance, but finding they conveyed no meaning, he was about to make the signal "Not Understood," when, suddenly, he heard an explosion, similar to

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a loud pistol shot, and at the same time, a vivid flash of light was seen to run along the conductors placed against the sides of the shed. These conductors (which vary in diameter from $\frac{2}{10}$ to $\frac{5}{10}$ of a millimètre) were broken into fragments, so hot, that they scorched the wooden tables on which they fell, and their edges presented evident traces of fusion. The wires of several electro-magnets, belonging to the apparatus placed in the shed, were also broken, and, at the same time, the attendant experienced himself a violent concussion which shook his whole frame.

The shed at Le Vesinet, where the lightning occasioned these remarkable phenomena is placed in connection with the Paris station, by wires supported on posts; yet at Paris nothing was broken—nothing remarkable occurred, excepting that several of the bells were heard to ring. But at about 200 mètres from Le Vesinet, the top of one of the posts, which support the wire, was split; several splinters had flown off from it, and the side facing the railroad bore, from top to bottom, evident traces of the passage of the lightning.

There are three of these wires between the Paris station and Le Vesinet; they rise vertically at right angles with the line of railway to the height of, from six to seven mètres, and are then bent over into the horizontal direction. At the corners of the angles, three brushes (*aigrettes*) of light were observed several seconds after the explosion.

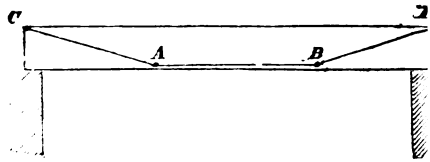
At the time of the explosion, an attendant, who was holding the handle which moves a needle placed at a short distance from the extremity of the atmospheric railway, sustained all over his body a violent concussion, and several workmen, standing about him, also experienced severe shocks.

In my opinion, the explosion came from the railway; for, on account of the immense quantity of metal employed in its construction, and the extent of its surface, it is very probable, that during a thunder storm, it may be the seat of an intense electric tension, and that the fluid thus attracted, may discharge itself on the telegraphic wires, which are not above three or four mètres distant from the iron rails, tubes, needles, &c.

In order to protect the attendants from the consequences of such terrible, and it may be fatal explosions, and to prevent the destruction of the apparatuses, I think it would be advisable to stop the conducting wires (which are from three or four millimètres in diameter) at five or six mètres from the station, and to connect them with the telegraphic apparatus by a number of very fine wires; which being of very small section, could transmit only a small quantity of electric fluid to the station: and, should a discharge take place, the main wires would melt or break, not *within*, but *without* the premises occupied by the attendants on the telegraph.

THE DEE BRIDGE ACCIDENT.

Sir,—I have just seen a diagram of the girder that gave way the other day at Chester, and quite agree with you that from the position in which the tension-rods are placed, they were, in that *instance, utterly useless.* For let C D be



the girder; C A, A B, B D, the tension-rods; A B fixed points in the girder, to which the eyes of the centre tension-bar A B are attached. Now, since the distance between A and B is fixed, and the tension-rod A and B extended between them, it follows, that undue pressure one cannot extend more than the other; and as wrought iron extends more than cast under the same pressure, they cannot act together—and therefore, especially if the temperature of the atmosphere should expand the tension-rods a little more than it does the girder, this inequality, however slight, would render the tension-bars entirely useless. These remarks, however, do not apply to the principle of tension-rods for cast girders generally, but only to the mode of applying them which Mr. Stephenson has adopted in the Dee Bridge.

In trussing a girder with tension-bars, the bars should be carried below the bottom flanges of the girder.

I am, Sir, yours, &c.,

WILLIAM DREDGE, C. E.

Bath, June 16th, 1847.

THE DEE BRIDGE ACCIDENT.

Sir,—Some of the witnesses examined at the inquest on the Dee bridge accident seem to have wished to establish the fact, that the bridge was all and everything a bridge ought to be, and that if it had not been for a supposed

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untoward accident,—the train leaving the rails while passing over the bridge—the girder would not have broken.

I do not think I clearly perceive the object these witnesses have in view. The public have surely a right to expect that railway bridges should be sufficiently strong to encounter such an accident as that of a train running off the line, without at once breaking down and precipitating the carriages.

For my own part, I should think such girders as the one which failed at the Dee bridge (judging from the published descriptions of it) far too *rigid* to be safe. Years ago the danger of making cast-iron beams too deep in proportion to their breadth was pointed out, and that such beams when loaded, were liable to be fractured by the slightest lateral blow or jar.

One of the witnesses cannot account for the train leaving the line; but it seems to me the accident might have happened without the train having left the line at all. Anything which caused the train to come suddenly against one side of the line, as an extraneous hard substance on the rails, &c., &c., would probably be quite sufficient to cause the accident.

I am, Sir, yours, &c.,
S. Y. (AN ENGINEER.)

June 14, 1847.

[It appears from a correspondence in the newspapers, to which this accident has given rise, that on May 2, 1846, Messrs. Locke, Stephenson, Brunel, and Cubitt addressed a joint letter to Lord Dalhousie, the then President of the Board of Trade, in which, referring to a provision in the Railway Clauses Consolidation Act, that railway bridges crossing public roads must rise 12 feet from the surface of the road before the springing of the arch, they say, "That height leaves only 4 feet in the case of turnpike roads, and 3 feet in the case of other public roads, for the rise or curve of the arches. We submit that, for arches so wide as the act requires, this rise is not sufficient, and our object in addressing you is to obtain your Lordship's aid in altering the springing height above the road from 12 feet to 8 feet, so as to give more curve, and consequently greater security to the arches. We have already found, in many instances, that it is impossible to comply with the requirements of the clause in question without resorting to iron girders; and in those parts of the country abounding in stone and brick, and where iron can only be obtained at a considerable distance, this obligation is attended with greatly increased cost and inconvenience"—ED. M. M.]

THE BRIGHTON RAILWAY ACCIDENT AND MR. KIRTLEY.

We observe from some proceedings which have taken place in the Queen's Bench, that the statement which we copied in our last number from the *Railway Record*, respecting the cause of this accident, has been contradicted on oath in all its more important particulars. We take the earliest opportunity open to us of publishing Mr. Kirtley's denial of its truth. The following is given in the *Times* as the substance of his affidavit:—

"With regard to the engine No. 40, the statement that Mr. Kirtley ordered the defective wheels to be replaced, was utterly untrue; the wheels had been repaired only a few days before; it had been running upon the line, and was in perfect repair on the day on which the accident took place. The circumstance also as to Johnson was untrue; for he was not at the time a servant of the company. The unfortunate person who was killed was named Gregory, and he had had considerable experience in driving."

AEROSTATION.

Sir,—I am induced to hazard a few remarks on aerostation, from observing a description of an "Archimedian Balloon" contained in a late number of your magazine. The phantom of "perpetual motion," after having beguiled our ingenious but non-practical enthusiasts for an indefinite period, has been succeeded by a series of inane attempts at "aerial navigation," as it is termed; and they bid fair to be no less tantalizing and futile.

Amongst the numerous propositions advanced upon this subject, that of Mr. Henson appears to me the only one constructed on principles which would promise even a shadow of success. The general desideratum, without which no scheme of aerial propulsion can be available in practice, is a source of power far less weighty than any hitherto discovered. Surely, then, the inventive brain of "balloonists" should be directed first to this point, in which considerable advances are necessary for *their* projects, and would

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be eminently desirable in the other universal branches of mechanics. Yet, strange to say, almost all our aeronauts leave untouched the source of propelling power, and furnish us with but clumsy means of its application.

Mr. Henson, indeed, announced his discovery of an engine not much troubled with the ordinary encumbrance of gravity; but I believe that our hopes, raised so high, have not been sustained by its appearance. As to Mr. Pitter, he informs us that, "With regard to the motive power for working the aerial machine, I am undecided!"

But supposing the discovery of a source of power which shall have so little weight as to be eligible for "aeronauts," how unscientifically is it generally proposed to be applied! The propelling machine is suspended, and its direction of force consequently some fifty feet distant from that of the resistance offered by the atmosphere. The inevitable result would be, that the balloon would *bend back* until the directions of these two forces met in the same point on the vertical through the centre of gravity of the balloon and appendages. However agreeable this little change of position might be to those possessed of sufficient courage to submit to it, I suspect that the event which would next succeed has not been anticipated by them, and this would be, that the balloon would continue its reclining posture until it assumed a horizontal position!—unless, indeed, the bags of gas proposed by Mr. Pitter, to be attached beneath for buoyancy (happy if they could, however, sustain themselves!), so equalize the horizontal resistance, as to induce the whole fabric to become recumbent on one side.

I am, Sir, yours, &c.,

JOHN M'GREGOR.

P. S.—So much of our periodical literature is intended for reading when travelling, or at times when the usual conveniences of a library table are absent, that it seems to me surprising that their pages are not cut at the booksellers. Undoubtedly there are many cases when, in purchasing these publications, the buyer would at once prefer a copy ready cut to those which are not so—and to this kind of books the objection does not apply, that "if the pages were cut they would appear to be second-hand."

[Custom in this, as in but too many other matters, overrides all considerations of utility. Among our go-a-head friends on the other side of the Atlantic, who must needs read as they run or not at all, such journals as ours are always ready cut; but according to the trade usage in this country a cut number is a used number, and would be rejected if offered for sale as new.—ED. M. M.]

THE ROYAL STEAM NAVY.

We congratulate the members of the engineer branch of this service on the justice which has been at length rendered to them by Government. By an Order in Council, which has been just promulgated the chief and assistant engineers are promoted to the rank of officers—a measure which we were the first to recommend, and have never ceased to advocate—and various other important advantages secured to them. We subjoin the new Rules and Regulations to which this Order has given rise.

Rules and Regulations as to the Appointment and Rank of Engineers.

Engineers in Her Majesty's naval service are to be classed in three divisions, and to be thus denominated:—

Inspectors of machinery afloat.
Chief Engineers.
Assistant Engineers.

The two latter divisions are to be divided severally into three classes, namely—

Chief Engineers of the first class.
,, of the second class.
,, of the third class.
Assistant Engineers of the first class.
,, of the second class.
,, of the third class.

Engineers will be considered, as at present, to belong to the civil branch of the naval service, and they will be appointed and rank as undermentioned:—

Inspectors of machinery afloat will be appointed by commission, and rank with, but after, masters of the fleet.

Chief engineers will be appointed by commission, and rank with, but after, masters.

Assistant engineers will be appointed by order. and rank with, but after, second masters.

Rules and Regulations as to the Examination and Qualifications of Engineers.

Inspectors of Machinery Afloat.

Inspectors of machinery afloat will be appointed by their Lordships for the responsible duties of superintending generally the machinery of steam-vessels attached to each station or squadron; and the candidates for such appointments must be men of experience and acknowledged ability, in whose judgment, integrity, and talent implicit reliance can be placed.

Chief Engineer.

No person will be considered qualified to hold the commission of a chief engineer who is not able to keep accounts, make notes in the log of every particular of the working of the engines and boilers, draw rough sketches of any part of the machinery, with figured dimensions fit to work from, be able and willing to exert himself practically as a workman when occasion requires, either in driving the

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engines, or packing, repairing, or adjusting the various working parts of the machinery, and making good the defects of boilers. He must, therefore, possess a thorough knowledge of the construction and working of marine engines and boilers in all their parts, coupled with skill and experience as a practical mechanic.

He must be so far acquainted with the elements of theoretical mechanics as to comprehend the general principles on which the machine works. He must understand how to apply the indicator, and draw the necessary conclusions from the diagrams.

He must be acquainted with the principle of expansion, and able to prove or at least to illustrate the advantages to be derived from the use of expansive gear.

The particular class to which a chief engineer will be appointed will depend not only on the result of his examination, but on his character, services, &c.

Chief engineers will be examined at the steam department at Somerset-house, by the chief engineer, and inspector of the machinery of the navy, in the presence of the comptroller of steam machinery.

Assistant Engineer.

He must be able to keep accounts, and make rough working sketches of engines and boilers.

He must produce certificates of servitude in a factory, or other proof of his acquaintance with engine-work, and of his practical abilites as a mechanic, as well as testimonials of good conduct and character.

He must understand the general principle of the engine, and be acquainted with the names of the various parts and their uses. The second class assistant engineer, in addition to the foregoing general acquirements must have served at sea at least one year, and produce proof of his capability to work engines, &c.

The first class assistant engineer, in addition to the foregoing general acquirements, must have served at sea at least two years as an engineer, and be competent to take charge of the engines when required to do so. He must be well acquainted with the principle on which the machine works in all its parts, be able to adjust the various working parts, and set right defects which may arise in the engines and boilers.

According to his acquirements in these points, his proficiency as a workman and his general character and servitude, will depend his promotion to the higher rank of chief engineer. But he will not be considered eligible for promotion to this latter rank until he shall have served three years in the capacity of first class assistant, or as "first class engineer" on the old establishment.

Assistant engineers will be examined by the chief engineers and inspectors of machinery of the Government factories, in the presence of the superintendent of the dockyard, or such other officer as may be nominated for the purpose.

In the event, however, of the exigencies of the service requiring the entry of engineers who may not have served at sea the full periods herein stated, but in other respects may produce proof of their qualifications, a deviation from these regulations will be allowed by the special authority, in each instance, of the Board of Admiralty, a notation to such effect being made on the passing certificates with a statement of the circumstances of the case.

All engineers at present in the service are to be continued at their present rank and denomination until they shall have been examined and found eligible for promotion into the new establishment.

Rules and Regulations as to the Pay of Engineers.

The pay of engineers on the new establishment will be regulated under the articles in the "Queen's Regulations" and "Admiralty Instructions," applicable to commission officers, except as regards the termination of their harbour-service pay, and commencement of sea pay, which will be regulated as directed in the case of warrant officers, under chap. x., art. 8, page 93, of the "Queen's Regulations."

Scale of Pay.

Rank.	Class.	Sea pay per month.			Harbour service pay per month.		
		£	s.	d.	£	s.	d.
Inspectors of machinery afloat....	.....	25	0	0	13	15	0
Chief engineers..	First	20	0	0	11	0	0
	Second	16	0	0	8	16	0
	Third	14	0	0	7	14	0
Assistant engineers............	First	12	0	0	6	12	0
	Second	9	10	0	5	4	0
	Third	8	0	0	4	4	0

N.B. They are not to receive any additional pay for service within the tropics, nor any compensation in lieu of the allowance for the instruction of boys.

When engineers borne for harbour duty may have charge of steam machinery, they are to receive sea pay.

When engineers are appointed from harbour service pay to sea-going ships, they will be entitled to receive three months' advance of pay.

When engineers are employed to execute any work, not for their own ship, they will be allowed extra pay (granted under the "Queen's Regulations," chap. x., sec. 4, art. 1, page 104) according to their rank.

THE DEE BRIDGE ACCIDENT.—THE VERDICT.

The inquest jury (Sir E. Walker, Chairman) have returned a verdict of "accidental death," accompanied with the following observations:

"We are further unanimously of opinion, that the aforesaid girder did not break from any lateral blow of the engine, tender, carriage, or van, or from any fault or defect in the masonry of the piers or abutments; but from its being made of a strength insufficient to bear the pressure of quick trains passing over it.

"We feel that the 11 remaining girders, having been cast from the same pattern, and of the same strength, are equally weak, and consequently equally dangerous for quick or passenger trains as was the broken one.

"We consider we should not be doing our duty towards the public if we separated without expressing our unanimous opinion, that no girder bridge of so brittle and treacherous a metal as cast-iron alone, even though trussed with wrought-iron rods, is safe for quick or passenger trains; and we have it in evidence before us, that there are upwards of 100 bridges, similar in principle and form to the late one over the river Dee, either in use or in the course of being constructed, on various lines of railways. We

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consider all these unsafe, more or less, in proportion to the span; still, all unsafe.

"We therefore call upon Her Majesty's Government to institute such an inquiry into the merits or demerits of these bridges, as shall either condemn the principle or establish their safety to such a degree, that passengers may rest fully satisfied there is no danger, although such bridges may deflect from $1\frac{1}{2}$ to 5 inches."

CALENDAR OF SPECIFICATIONS OF PATENTS OF INVENTIONS. FROM THE PERIOD WHEN THE PRACTICE OF ENROLMENT COMMENCED TO THE PRESENT TIME.—CONTINUED FROM P. 552.

CONTINUED FROM P. 552.

[From the Reports of the Deputy-Keeper of the Public Records (Sir Francis Palgrave).]

THE CALENDAR.

[Of the two dates annexed to each entry, the first is the date of the patent, and the second that of the enrolment of the specification.]

Robert Barker, of Edinburgh, portrait painter: of an entire new contrivance of apparatus, called (by the specifier) "La Nature à Coup-d'-œil," for the purpose of displaying views of Nature at large by oil painting, fresco, water colours, crayons, or any other mode of painting or drawing. Cl. R., 27 Geo. 3, p. 4, No. 8. June 19, 27 Geo. 3; July 3, 1787.

John Wyatt, of Essex-street, Middlesex, gent.: of a powder to be used on all occasions where the mixture of oil or oily substances with acetous or watery liquors is required. Cl. R., 27 Geo. 3, p. 4, No. 7. June 5, 27 Geo. 3; July 4, 1787.

Humphrey Walton, of St. Pancras, Middlesex, musical instrument maker: of certain new improvements on the musical instrument called the pianoforte, and other instruments. Cl. R., 27 Geo. 3, p. 4, No. 2. May 25, 27 Geo. 3; June 15, 1787.

William Stedman, of Carey-street, Middlesex, perfumer: of a philosophical fire-alarm, to be applied to houses and other buildings. Cl. R., 27 Geo. 3, p. 4, No. 1. May 19, 27 Geo. 3; June 19, 1787.

Rev. Dr. Anselm Bayl[e]y, of Middle Scotland-yard, Middlesex: of a method of making elastic girdles, bandages, or rollers, the most useful and convenient, to prevent and relieve ruptures, fractures, sprains, and swellings of every kind, and which is on an entire new construction. Cl. R., 27 Geo. 3, p. 6, No. 1. July 20, 27 Geo. 3; Aug. 14, 27 Geo. 3, 1787.

(*To be continued.*)

Atmospheric Railway System.—Erratum.—Happening to cast my eye over a former paper of mine in No. 1207 of this Magazine on "the Velocity of the Atmospheric Railway," I see that by the omission of a nought, the whole of the calculation is rendered erroneous. The accelerating force is as there stated,

$$= \frac{3015 \times 32.2}{50 \times 20 \times 112} \text{ which} = \frac{97083}{112000} \text{ or nearly}$$

one foot per second, instead of $\frac{97083}{11200}$ as there printed. As the atmospheric, however, is defunct, it matters little what it *ought* to have done, though by the above omission of "nothing," I unconsciously gave it ten times as much to do, as could be *reasonably* expected.

A. H.

LIST OF ENGLISH PATENTS GRANTED FROM JUNE 12, TO JUNE 16, 1847.

William Beckett Johnson, of Manchester, engineer, for certain improvements in the construction of locomotive engines, to be used upon rail or other ways, which improvements are also applicable to carriages used upon railways. June 12: six months.

James Johnson, of Bradley, in the county of Stafford, iron-founder and boiler-maker, for improvements in machinery for the manufacture of rivets, railway or other pins, bolts, nuts, and spikes. June 12: six months.

John Mercer, of Oakenshaw, and John Greenwood, of Church, both in the county of Lancaster, chemists, for improvements in certain substances applicable to the manufacture, scouring, and washing wool and woollen fabrics and other substances. June 12: six months.

George Edmund Donisthorpe, of Leeds, in the county of York, manufacturer, for improvements in roving and spinning wool and flax, and in treating wool previous to spinning, and in heckling flax. June 12: six months.

Joseph Wilcock, of Barnsley, in the county of York, gentleman, for certain improvements in the ventilation of mines. June 12: six months.

James Richards, of New York, engineer, for improvements in constructing pistons. June 12: six months.

Francis Bowes Stevens, of Hoboken, in the county of Hudson, in the State of New Jersey, in the United States of America, engineer, for improvements in applying means and apparatus to ships and vessels to improve their speed. June 12: six months.

John Lane, of Oriel-street, Liverpool, brewer, for improvements in railway carriages and engines. June 15: six months.

Richard Roberts, of Manchester, engineer, for improvements in machinery for preparing and spinning cotton and other fibrous substances. June 15: six months.

James Timmins Chance, of Handsworth, in the county of Stafford, glass manufacturer, for improvements in the manufacture of glass. (Being a communication.) June 15: six months.

John Lane Higgins, Esq., of Oxford-street, Middlesex, for improvements in the construction of winches and windlasses. June 15: six months.

Frederick Theodore Philippi, of Bellfield Hall, in the county of Lancaster, calico printer, for certain improvements in machinery or apparatus for stretching, drying, and finishing woven fabrics. June 15 six months.

Alexander Symons, of London-street, Fenchurch-street, merchant, for improvements in railway carriages, in preventing accidents on railways, and in ascertaining the speed of carriages. June 15: six months.

James Houghton, of Oldham, in the county of Lancaster, engineer, for certain improvements in machinery or apparatus to be used in the preparation and spinning of cotton, wool, and other fibrous substances. June 15: six months.

Henry Pooley, of Liverpool, iron-founder, for certain improvements in weighing machines. June 16: six months.

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LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
June 11	1097	Isaac Laslett	Farnborough, Kent	Brick and tile machine.
12	1098	W. H. Bentley	Bedford, ironmonger	The Universal Boiler, or Kettle.
15	1099	Alexander Wright	Holywell-street, Millbank	Apparatus for testing the quantity of proof spirits in mixtures of alcohol and water.
,,	1100	Henry Badger	West Bromwich	Blinds for the lower part of windows.
17	1101	Frederick Richd. Louis Koepp	14, Chadwell-street	Carriage telegraph.

Advertisements.

TO MINE AND COLLIERY PROPRIETORS, SLATE QUARRY OWNERS, RAILWAY CONTRACTORS, IRONMONGERS, DEALERS IN GUNPOWDER, AND OTHERS.

MESSRS. JOHN HALL AND SON, THE PATENTEES AND SOLE MANUFACTURERS OF

SCHONBEIN'S PATENT GUN-COTTON,

Respectfully state, that they are now prepared to SUPPLY the PATENT GUN-COTTON (compressed for the convenience of carriage), in round and square paper cases, of 4 ozs. each, packed in boxes, containing 50 and 100 cases each, at the price of 3s. per lb., for ready money.

Also, in tubes or cartridges of... 1, 1⅛, 1¼, and 1½ inch diameter;
Containing .... 2, 4, 6, and 8 ounces each, at the
Additional charge of............. 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 3 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

Office, 23, *Lombard-street, London.*

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

H. ELLIS,

MACHINIST and MODELLIST, of 9, Three Kings Court, Lombard Street, begs to acquaint those engaged in Mechanical Arts, either as practical men, inventors, or amateurs, that he executes orders for models of inventions and apparatus for experimental purposes; also in wheel and screw-cutting, ornamental, spiral, and general turning, and for optical, mathematical, and philosophical instruments, with precision, neatness, and economy.

Electric Telegraphs.

AS Inventors and Patentees of the ELECTRO-TELEGRAPHIC CONVERSER, the principle of which is far more simple, certain, and perfect than that of any of the Telegraphs at present known to the world, we cannot but deplore the necessity for still keeping secret the details of the various improvements comprised in our patents, because we are confident that, when once they are made public, their advantages will be so manifest as to sink the best of its predecessors into comparative insignificance.

When we assert that our instrument is not subject to derangement from atmospheric influences, that it is perfectly free from vibration, and that its power is unlimited, which we shall be able to demonstrate by its application to *a thousand miles of wire*, through a greater number of instruments than can be used under any existing system, we hope that we have said sufficient to induce all concerned to await the enrolment of our specification, which must take place in August. We avail ourselves of this opportunity of disclaiming all connexion with any printing telegraph.

BRETT & LITTLE.

140, Holborn Bars.

To Institutions, Lecturers, Surgeons, and Scientific Persons.

For Sale.

AT No. 5, Tavistock-row, Covent-garden.—The valuable, complete, and extensive Philosophical Apparatus, Oxy-hydrogen microscope, Anatomical slides, Wax Preparations and Drawings, Surgical Instruments, Medical Books, and Medicines. The property of a Gentleman deceased. The whole to be disposed of immediately.

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The Patent Gutta Percha Driving Bands.

THE GUTTA PERCHA COMPANY beg to acknowledge the extensive patronage they have already received for their Patent Bands, and inform their numerous friends that, having completed the erection of their New Machinery, they are now prepared to execute orders without delay.

THE PATENT GUTTA PERCHA BANDS are now well known to possess superior advantages, viz., *great durability and strength, permanent contractility and uniformity of substance and thickness*, by which all the irregularity of motion occasioned by piecing in leather straps is avoided. They are not affected by fixed Oils, Grease, Acids, Alkalies, or Water. The mode of joining them is extremely simple and firm. They grip their work in a remarkable manner, and can be had of any width, length, or thickness, without piecings. All orders forwarded to the Company's Works, Wharf-road, City-road, will receive immediate attention.

E. GRANVILLE, Manager.

London, May 17, 1847.

List of Prizes for Session 1847--8.

THE ROYAL SCOTTISH SOCIETY of ARTS proposes to award Prizes of different values (none to exceed Thirty Sovereigns), in Gold or Silver medals, Silver Plate, or Money, for approved Communications, relative to inventions, discoveries, and Improvements in the *Mechanical* and *Chemical* Arts in General, and also to means by which the *Natural Productions* of the Country may be made more available; and, in particular, to,—

I. INVENTIONS, DISCOVERIES, or IMPROVEMENTS in the Useful Arts, including the *Mechanical* and *Chemical*; and in the Mechanical Branch of the *Fine Arts*; such as the following, viz.:—

I. *Mechanical Arts.*

1. METHODS of Economising Fuel, Gas, &c.,—of Preparing Superior Fuel from Peat,—of Preventing Smoke and Noxious Vapours from Manufactories, —of Warming and Ventilating Public Edifices, Private Dwellings, &c.—of constructing Economical and Salubrious Dwellings for the Working Classes, especially in Towns,—of Filtering Water in large quantities,—of rendering large supplies of Water available for the purpose of extinguishing Fires; and the best application of Manual or other Power to the working of Fire-Engines,—of Constructing buildings on the most correct Acoustic principles.

2. INVENTIONS or IMPROVEMENTS in the manufacture of Iron, and other Metals, simple or alloyed,—in the Manufacture of Writing and Printing Paper,—in Tuyeres for Blast Furnaces,—in the Making and Tempering of Steel,—in Gilding Brass equal in Colour to the French,—in Artificial Pavement,—in Balance or Pendulum Time-Keepers, moved by Weights or Springs; or in Electro-Magnetic Time-Keepers,—in Screw-cutting,—in Printing-Presses,—in Stereotyping, and in cleaning the plaster from the Types,—in Furnaces and other Apparatus used in Stereotyping, —in Type-Founding,—in the Composition of Printers' Rollers,—in Ship-Building, with regard to Ventilation, both for the Crew and the Timbers, —in Currying and Tawing of Leather,—in Preparing Black Polished Leather equal to the French,—in Stationary and Locomotive Engines, —in Railway Wheels and Axles,—in Railway Telegraphs and Signals,—in Smith-Work and Carpentry,—in Tools, Implements, and Apparatus for the various trades,—in Electric, Voltaic, and Magnetic Apparatus.

2. *Chemical Arts.*

IMPROVEMENTS in Fine Glass for Optical Purposes, free from Veins, and of a Dense and Transparent quality, equal or superior to the best Continental Glass,—also in rendering Glass hard and difficult of fusion for Chemical purposes,—in the Annealing of Glass,—in the Manufacture of Writing Inks, both Common and Copying, so as to flow freely from Metallic Pens,—in the Dissolving of Caoutchouc, and applying it to useful purposes.

3. *Relative to the Fine Arts.*

IMPROVEMENTS in Patterns of Porcelain, Common Clay, or Metal, of Domestic Articles of simple and beautiful Forms, without much Ornament, and of one Colour,—in the Preparation of Lime and Plaster for Fresco Painting, and in appropriate tools for laying the Plaster with precision,—in Engraving on Stone,—in Daguerreotype, Talbotype, or other photographic processes,—in applying such processes to stone, for Lithographic Printing,—in Electrotype processes,—in the production of White or Neutral Artificial Light by means adapted to ordinary use,—in Die-sinking, in Wood-cutting, and other methods of illustrating Books to be printed with the Letter-press,—in Printing from Wood-cuts, &c.,—in Ornamental Metallic Casting.

II. EXPERIMENTS applicable to the Useful Arts.

III. NOTICES of Processes in the Useful Arts practised in this Country, but not generally known.

IV. INVENTIONS, Processes, or Practices from Foreign Countries, not generally known or adopted in this country,—such as the Manufacture of Glass Pipes for Conveying water, Gas, &c.

V. PRACTICAL DETAILS of Public or other Undertakings of National importance, not previously published.

VI. DISCOVERY of Substitutes for Hemp and Flax, &c.

The SOCIETY also proposes to award the KEITH PRIZE, value THIRTY Sovereigns,

For some important "Invention, Improvement, or Discovery, in the Useful Arts, which shall be primarily submitted to the Society," betwixt and 1st April, 1848.

GENERAL OBSERVATIONS.

The Communications and the Descriptions of the various inventions, &c., to be *full* and *distinct*, and to be written on *Foolscap* paper leaving margins at least one inch broad, on *both the outer and inner sides of the writing*, so as to allow of their being bound up in volumes; and, when necessary, to be accompanied by *Specimens, Drawings, or Models*. All drawings to be on *Imperial* Drawing Paper, unless a larger sheet be requisite. The drawings, and the Letters or Figures of Reference, to be in *bold* lines, or *strongly coloured*, so as to be easily seen from some distance when hung up in the Hall of meeting.

The Society to be at liberty to publish in their Transactions copies or abstracts of all Papers submitted to them. All Models, Drawings, &c., for which Prizes shall be given, to be held to be the property of the Society; the Value of the Model being taken into account in fixing the amount of the Prize.

Communications, Models, &c., are to be addressed to JAMES TOD, Esq., the Secretary, 21, Dublin-street, Edinburgh, postage or carriage paid; and they are expected to be lodged *on or before* 1st *October* 1847, in order to ensure their being read and reported on during the Session, the ordinary Meetings of which end in April 1848; but, those *which cannot be lodged earlier*, will be received up to 1st of March, 1848.

By order of the Society,

JAMES TOD, *Secretary*.

Edinburgh, 12th April, 1847.

*** Copies of this List of Prizes may be had from the Secretary.

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To Inventors and Patentees.

MESSRS. ROBERTSON & CO.,

PATENT SOLICITORS,

(Of which firm, Mr. J. C. ROBERTSON, the EDITOR of the MECHANICS' MAGAZINE from its commencement in 1823, is principal partner,) undertake

The procuration of Patents

For England, Scotland, Ireland, and all Foreign Countries, and the transaction generally of all business relating to PATENTS.

Specifications Drawn or Revised.

DISCLAIMERS, AND MEMORANDUMS OF ALTERATION PREPARED AND ENROLLED.

Caveats Entered and Oppositions Conducted,

CONFIRMATIONS AND PROLONGATIONS OF PATENTS SOLICITED.

Searches made for Patents, and Copies or Abstracts Supplied.

Advice on Cases submitted, &c. &c.

MESSRS. ROBERTSON & CO.

POSSESS THE ONLY COMPLETE REGISTRY OF PATENTS EXTANT,

Commencing A.D. 1617 (15 James I.) and regularly continued down to the present time.

INTENDING PATENTEES supplied gratis with Printed Instructions, on Application, either personally or by letter.

Advantages of Registering Designs for Articles of Utility.

Under the New Designs Act, 6 and 7 Vic. c. 65.

Protection for the whole of the three Kingdoms by one Act of Registration.

Protection for a term of three years.

Protection at a moderate expense (from £12 to £20).

Protection immediate (may be obtained in most cases within a couple of days).

Power of granting licenses for any of the three Kingdoms, or any of the cities, towns, or districts thereof, to one, two, three, or any greater number of persons.

Summary remedy for Infringements.

For a copy of the Act, with Table of Fees, and Explanatory Remarks, see *Mechanics' Magazine*, No. 1047, price 3*d.*; and for Lists of Articles registered under the New Act, see the subsequent Monthly Parts.

Specifications and Drawings, according to the provisions of the Act, prepared, and Registrations effected without requiring the personal attendance of parties in London, by Messrs. ROBERTSON and Co., Patent and Designs Registration Agents, 166, Fleet-street.

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Spence on the Specification of a Patent.

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A TREATISE on the Principles relating to the Specification of a Patent for Invention; showing the standard by which the sufficiency of that instrument is to be tried.

By William Spence, Assoc. Inst. C.E., Patent Agent.

London: Stevens and Norton, 26, Bell-yard, Lincoln's-Inn, and 194, Fleet-street.

Published this Day, price Five Shillings,

Microscopic Objects—Animal Vegetable, and Mineral.

CONTENTS.

Catalogue of Microscopic Objects.
Recent Improvements in Microscopes.
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Animals and Plants exhibiting Circulation.
Microscopic Objects by Polarized Light.
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NOTICES TO CORRESPONDENTS.

Will A. H. do us the favour to send on Monday for a letter addressed to him?

E. P. P. must have been grossly misinformed, and on that supposition is excused. His post-office order has been returned to the postmaster by whom it was issued, and to whom he can apply for restitution of the amount.

Z.—Magnets may be made probably of any weight (Dr. Scoresby spoke once of making one to weigh a ton)—but the augmentation of power diminishes in an exact ratio with the increase of thickness.

Libra's communication is not suited to our pages.

Communications received from Textilia—C. P. D.—Pincher—Mr. R. B. Lawson—Philo—Alban—Right Line—M.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1246.] SATURDAY, JUNE 26. [Price 3*d*.

Edited by J. C. Robertson, 166 Fleet-street.

LOWTHORP'S WICKET-GATE FOR CANAL LOCKS.

Fig. 1.

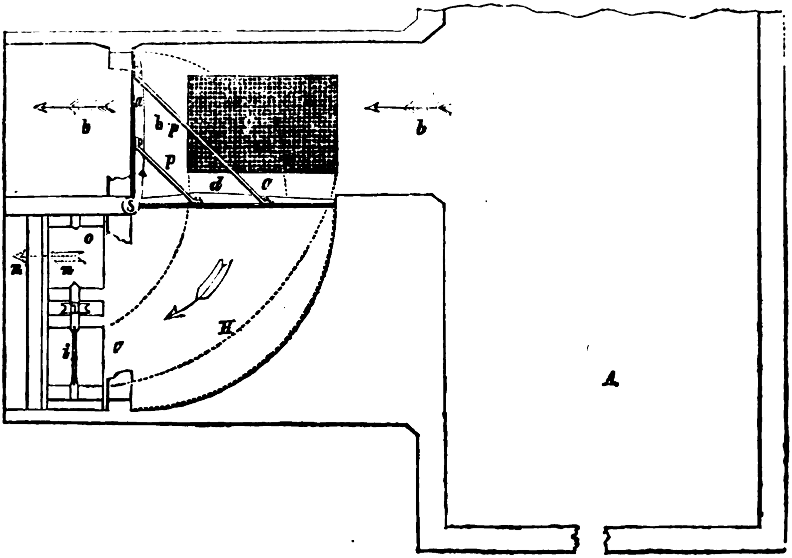


Fig. 2.

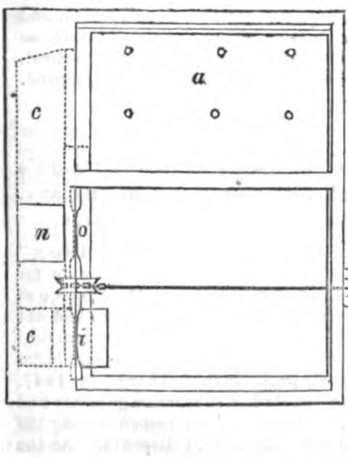
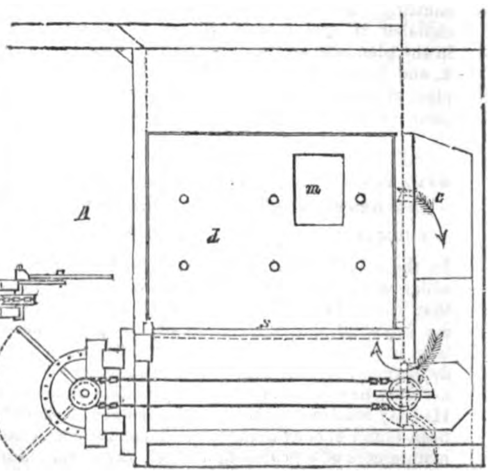


Fig. 3.



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LOWTHORP'S WICKET-GATE FOR CANAL LOCKS.

The inventor of this apparatus is a Mr. F. C. Lowthorp, C. E., of Pennsylvania. The object of it is to draw water rapidly from a higher level to a lower: for example, to fill or empty lock chambers, or to draw off a canal level, mill-race, or reservoir of any kind. The Science and Arts Committee of the *Franklin Institute,* in a report which they have made upon it, which is published in the last number of the journal of the Institute, say,—"The time and effort required to manœuvre the canal wickets (Mr. Lowthorp's) will certainly not be greater than is necessary to work one of the simple turning wickets generally used in lock-gates, while the quantity of water discharged by the sluice will, with the above proportions" (sluice 3 feet wide and 5 high, with an opening of 15 square feet), "be about *fourfold*, and may, by a variation of the relative dimensions of the parts, be greatly increased." The following is Mr. Lowthorp's description of the details:

Fig. 1 is a plan, in which the part A is intended to represent a reservoir, lock-chamber, &c. *a d* shows the leaves of the "wicket-gate" (which is supposed to be placed in the side wall of a lock), both of which are secured to the shaft *s*, and are connected by means of the rods or bars *p p*. H is a recess or chamber, into which the leaf *d* moves in opening the leaf (or gate) *a*; *i o* are small valve-gates (so connected, or coupled, *that both may be turned at the same time,* the one opening, and the other shutting) used for emptying and filling the chamber H, and may be worked as shown in the plan and sectional views (see figs. 1, 2, and 3), or otherwise. *c c* is a channel or pipe, communicating with the water in the (lock-chamber, or) reservoir A and the chamber H through the valve-gate *i*. *g* is a grating intended to prevent the channel *c c* from becoming obstructed. *n n* is a channel or pipe communicating with the chamber H and the lower level through the valve-gate *o*. *m* is a man-hole in the leaf *d*, for the purpose of getting at the small valve-gates *i o*, for repairs and other purposes. *b b b* shows the water-way communicating with the reservoir and the level below.

Fig. 2 is a longitudinal section of the plan, or fig. 1.

Fig. 3 is a cross section of the same.

The plan represents the wicket-gate as closed, and the lock, as well as the chamber H, full of water. When it is desired to empty the *lock*, the valve-gate *o*, communicating with the lower level through the channel *n n*, is opened; at the same time, the valve-gate *i* (which is connected with the same), communicating with the lock-chamber through the pipe *c c*, is closed; the water is thus discharged from the chamber H, and the pressure of the water, acting on the larger leaf *d*, forces the (gate, or) smaller leaf *a* open. The water in the lock-chamber is then discharged through the passage *b b b*.

The inventor does not propose to confine himself to the precise mode of construction shown in the plan, but purposes availing himself of different modes of construction to suit different localities where gates for discharging water are used; the principle remaining the same, which consists in alternately applying and relieving the pressure from one side of the larger leaf (arm, or paddle) of a wicket-gate, thereby causing it to turn one way or the other, so as to force the other leaf of the gate open or shut, as may be desired; both leaves of the (valve-gate, or) wicket-gate being secured to, and made to turn on, or with, the same shaft, or axis; the shaft being placed in a vertical, horizontal, or in any other position desired.

REMARKS ON CERTAIN MATHEMATICAL PRIZE QUESTIONS PROPOSED IN THE "LADY'S AND GENTLEMAN'S DIARY" FOR THE YEARS 1844, 1845, AND 1846. BY THE REV. THOMAS P. KIRKMAN, A.B., RECTOR OF CROFT WITH SOUTHWORTH, LANCASHIRE.

In the only communication ever made by me to the "Lady's and Gentleman's Diary," which was in the year 1845, was included the following solution of the prize question for that year. The "Diary" for 1846 acknowledged my solutions, but contained no notice of my denial of the enunciation of the prize question. Conceiving that my paper had not been completely perused, I wrote a respectful note to the learned editor of the mathematical department of that miscellany, requesting his attention to my reasoning; to which letter no reply has been made, either privately or in the editorial pages of the "Diary" for 1847. Had my solution not been acknowledged, I should have concluded that my arguments had been found unconvincing; but I cannot feel content, to be placed on record among the maintainers of a proposition which my communication was intended to disprove. As the

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error here pointed out has not yet, as far as I know, been corrected in any publication, I hope that the following investigation will not be unacceptable to mathematicians.

Prize Question, Lady's and Gentleman's Diary, 1845.

On the three sides of a plane triangle, as diameters, let circles be described; then, if circles be described to touch them, the sum of the reciprocals of the radii of three of these circles will be equal to the sum of the reciprocals of the other five.

Solution.

The above is not generally true; but, in an infinite number of cases, the sum of the reciprocals of four of these radii will be equal to the sum of the reciprocals of the other four.

Proof.

Let A′B′C′ be the angles of the given triangle, opposite in that order to $2a$, $2b$, $2c$, the given sides, and let not $a < b$. nor $b < c$.

Let the three given centres in these given sides be (A or a'), (B or b'), and (C or c').

Let $e_1\ e_2 \ldots e_8$ be the sought centres, and $\frac{1}{v_1}, \frac{1}{v_2}, \ldots \frac{1}{v_8}$, the corresponding radii, all > or $= 0$.

$$\begin{aligned}
\text{Let } 2s &= a+b+c, & n_1 &= \sin\frac{A'}{2}, & u_1 &= \cos\frac{A'}{2},\\
2s_1 &= -a+b+c, & n_2 &= \sin\frac{B'}{2}, & u_2 &= \cos\frac{B'}{2},\\
2s_2 &= a-b+c, & & & &\\
2s_3 &= a+b-c, & n_3 &= \sin\frac{C'}{2}, & u_3 &= \cos\frac{C'}{2}.
\end{aligned}$$

Let E_{ab} denote an ellipse, having its foci at a' and b', and axis major $= a+b$.

Let H_{ab} denote an hyperbola, having its foci at a' and b', and axis major $= a-b$.

It is easily seen that the intersections of E_{ab} and E_{ac}, of E_{bc} and E_{ac}, of E_{ab} and E_{bc}, will give six of the sought centres, and that those of H_{ab} and H_{ac} will give the other two.

$$(1)\left\{\begin{array}{llll}
\text{Let } e_1 \text{ and } e_2 \text{ be the intersections of} & E_{ab} \text{ and } E_{ac}, & \text{which are also those of} & H_{bc} \text{ and } E_{ac},\\
e_3 \text{ and } e_4 \quad ,, & E_{bc} \text{ and } E_{ac}, & ,, & H_{ab} \text{ and } E_{bc},\\
e_5 \text{ and } e_6 \quad ,, & E_{ab} \text{ and } E_{bc}, & ,, & H_{ac} \text{ and } E_{bc}.
\end{array}\right.$$

Inspection of the constructed curves will show that e_1, e_4, e_6, as well as e_7, which are the centres nearest the angle A'_1, when $A' < 90°$, all coincide with the vertex of A' when $A' = 90°$, and as A' further increases, re-appear, each still on its own hyperbolic branch, in angles vertically opposite to their positions when $A' < 90°$. The 8 circles and their contacts with the given circles may be conveniently designated thus, the upper or lower line being taken, according as A' is acute or obtuse; the centres being in order $e_1\ e_2 \ldots e_8$:

$Ab'c'$	$a'BC$	$Ca'b'$	$c'AB$	$Ba'c'$	$b'AC$	$a'b'c'$	ABC
1	2	3	4	5	6	7	8
$(a'BC)_2$	$a'BC$	$Ca'b'$	$(Ca'b')_2$	$Ba'c'$	$(Ba'c')_2$	$(ABC)_2$	ABC;

where the large or small letter denotes that the given circle, having that letter at its centre, is touched on its outer or inner rim by the sought circle.

The following are given values of the lines Ae_1 &c., the upper or lower sign being taken, according as $A' <$ or $> 90°$, and in them the definitions (1) are implied.

$$(2)\left\{\begin{array}{l}
Ae_1 = a \pm \frac{1}{v_1};\ Ae_2 = a - \frac{1}{v_2};\ Ae_3 = a - \frac{1}{v_3};\ Ae_4 = a + \frac{1}{v_4};\ Ae_5 = a - \frac{1}{v_5};\ Ae_6 = a \pm \frac{1}{v_6};\\
Be_1 = b \mp \frac{1}{v_1};\ Be_2 = b + \frac{1}{v_2};\ Be_3 = b - \frac{1}{v_3};\ Be_4 = b \pm \frac{1}{v_4};\ Be_5 = b + \frac{1}{v_5};\ Be_6 = b \mp \frac{1}{v_6};\\
Ce_1 = c \mp \frac{1}{v_1};\ Ce_2 = c + \frac{1}{v_2};\ Ce_3 = c + \frac{1}{v_3};\ Ce_4 = c \mp \frac{1}{v_4};\ Ce_5 = c - \frac{1}{v_5};\ Ce_6 = c \pm \frac{1}{v_6}.
\end{array}\right.$$

The focus being the pole, and r and 2θ the co-ordinates of any point in the curve, 2θ being measured from the *ax. maj.* towards the centre;

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(3) $\dfrac{s}{r} = 1 + \dfrac{c}{s_3}\sin^2\theta$ is the equation to E_{ab};

(4) $\dfrac{s}{r} = 1 + \dfrac{b}{s_2}\sin^2\theta$ „ „ E_{ac};

(5) $\dfrac{s}{r} = 1 + \dfrac{a}{s_1}\sin^2\theta$ „ „ E_{bc}.

To find e_1 and e_2, take A for origin, measure 2θ from AB, and putting $\theta - \dfrac{A'}{2}$ for θ in (4), eliminate r between (3) and (4). We thus obtain,

$\operatorname{Sin}^2\theta = \dfrac{n_1^2 b s_3}{c s_2 \mp bc \sin A' + b s_3}$, which two values being substituted in (3), will give $\dfrac{1}{Ae_1}$ and $\dfrac{1}{Ae_2}$. Let these values be $\sin^2\theta_1$ and $\sin^2\theta_2$. Putting for Ae_1 and Ae_2 their values in (2) and equating their reciprocals to those found from (3), we obtain after a little reduction,

$$(6) \qquad \mp v_1 - v_2 = \frac{1+\dfrac{c}{s_3}\sin^2\theta_1}{s_1 - \dfrac{ac}{s_3}\sin^2\theta_1} + \frac{1+\dfrac{c}{s_3}\sin^2\theta_2}{s_1 - \dfrac{ac}{s_3}\sin^2\theta_2},$$

where the ambiguity of sign in the denominator of $\sin^2\theta_1$ is opposite to that in the denominator of $\sin^2\theta_2$. In the process of reduction and addition of these 2 fractions, the ambiguity disappears, and we obtain

$$(7) \qquad \pm v_1 - v_2 = \frac{2\left\{-\dfrac{n_1^2}{a} + \dfrac{u_2^2}{b} + \dfrac{u_3^2}{c}\right\}\left\{-n_1^2 + n_2^2 + n_3^2\right\} - 4u_1 n_2 n_3 \dfrac{\sin A'}{a}}{(u_1^2 + u_2^2 + u_3^2 - 1)^2 - 4u_1^2 u_2^2 u_3^2}.$$

In like manner, taking B for origin, and proceeding to find e_5 and e_6, we deduce,

$$(8) \qquad \mp v_6 + v_5 = \frac{2\left\{\dfrac{u_1^2}{a} - \dfrac{n_2^2}{b} + \dfrac{u_3^2}{c}\right\}\left\{n_1^2 - n_2^2 + n_3^2\right\} - 4nun_{123}\dfrac{\sin A'}{a}}{(u_1^2 + u_2^2 + u_3^2 - 1)^2 - 4u_1^2 u_2^2 u_3^2}.$$

Then taking C for origin, and proceeding to find e_4 and e_3, we deduce,

$$(9) \qquad \mp v_4 + v_3 = \frac{2\left\{\dfrac{u_1^2}{a} + \dfrac{u_2^2}{b} - \dfrac{n_3^2}{c}\right\}\left\{n_1^2 + n_2^2 - n_3^2\right\} - 4nnu_{123}\dfrac{\sin A'}{a}}{(u_1^2 + u_2^2 + u_3^2 - 1)^2 - 4u_1^2 u_2^2 u_3^2}.$$

Finally, by addition and reduction, (7)(8)(9),

$$(10) \; \pm v_1 - v_2 \mp v_4 + v_3 \mp v_6 + v_5 = \frac{2\left\{\dfrac{n_1^2}{a} + \dfrac{n_2^2}{b} + \dfrac{n_3^2}{c}\right\}\left\{u_1^2 + u_2^2 + u_3^2 - 1\right\} - 4uuu_{123}\dfrac{\sin A'}{a}}{(u_1^2 + u_2^2 + u_3^2 - 1)^2 - 4u_1^2 u_2^2 u_3^2};$$

where the upper or lower sign is to be taken, according as $A' <$ or $> 90°$.

Since, taking upper or lower sign according as A' is acute, or somewhat obtuse,

(11) $\dfrac{1}{v_7} = \pm(a - Ae_7) = \pm(b - Be_7) = \pm(c - Ce_7)$, and since

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(12) $\dfrac{1}{v_8} = \quad a + Ae_8 \quad = \quad b + Be_8 \quad = \quad c + Ce_8$; it follows that

e_8 is on that branch of H_{ab} which is about A, and e_7 on that about B; and e_8 is on that branch of H_{ac} which is about A, and e_7 on that about C.

(13) $\dfrac{s_1}{r} = 1 - \dfrac{c}{s_2}\sin^2\theta$ is the equation to the branch of H_{ab} about A.

(14) $\dfrac{s_1}{r} = 1 - \dfrac{b}{s_3}\sin^2\theta$ is that to the branch of H_{ac} about A.

Taking A for origin, A B for axis, we obtain from these by putting $\left(\dfrac{A'}{2} - \theta\right)$ for θ in (14).

$$(15) \qquad \operatorname{Sin}^2\theta = \frac{n_1^2 b s_2}{c s_3 \pm 2u_1\sqrt{b c s_2 s_3} + b s_2}$$

one of which values being substituted in (13) will give $\dfrac{1}{Ae_8}$. A being still origin, and A B the axis,

$$(16) \qquad \frac{s_1}{r} = -1 + \frac{c}{s_2}\cos^2\theta \text{ is the equation to the branch of } H_{ab} \text{ about B.}$$

$$(17) \qquad \frac{s_1}{r} = -1 + \frac{b}{s_3}\cos^2\left(\frac{A'}{2} - \theta\right) \text{ is that to the branch of } H_{ac} \text{ about C.}$$

$$(18) \quad \text{Hence} \quad \operatorname{Cos}^2\theta = \frac{n_1^2 b s_2}{c s_3 \mp 2u_1\sqrt{b c s_2 s_3} + b s_2},$$

one of which values, being substituted in (16), will give $\dfrac{1}{Ae_7}$.

Equating these values of $\dfrac{1}{Ae_8}$ and $\dfrac{1}{Ae_7}$, thus found, to those deduced from (11) and (12),

$$(19) \quad \text{we get } v_8 \pm v_7 = \frac{1 - \dfrac{c}{s_2}\sin^2\theta_8}{s - \dfrac{ac}{s_2}\sin^2\theta_8} + \frac{1 - \dfrac{c}{s_2}\cos^2\theta_7}{s - \dfrac{ac}{s_2}\cos^2\theta_7};$$

where the ambiguities are contrary in the denominators of $\sin^2\theta_8$ and $\cos^2\theta_7$.

Placing for these their values in (15) and (18), and reducing, we obtain

$$(20) \qquad v_8 \pm v_7 = \frac{\dfrac{n_1^2}{a} + \dfrac{n_2^2}{b} + \dfrac{n_3^2}{c} + \dfrac{\sin A'}{a}}{u_1^2 + u_2^2 + u_3^2 - 1 + 2\,u_1u_2u_3} + \frac{\dfrac{n_1^2}{a} + \dfrac{n_2^2}{b} + \dfrac{n_3^2}{c} - \dfrac{\sin A'}{a}}{u_1^2 + u_2^2 + u_3^2 - 1 - 2\,u_1u_2u_3},$$

of which two fractions we know that the second represents $\pm v_7$, because its denominator vanishes when $A' = 90°$. Adding these fractions, we have

$$(21) \quad v_8 \pm v_7 = \frac{2\left\{\dfrac{n_1^2}{a} + \dfrac{n_2^2}{b} + \dfrac{n_3^2}{c}\right\}(u_1^2 + u_2^2 + u_3^2 - 1) - 4u_1u_2u_3\,\dfrac{\sin A'}{a}}{(u_1^2 + u_2^2 + u_3^2 - 1)^2 - 4u_1^2u_2^2u_3^2}$$

When therefore $A' < 90°$, we have by (10 and (21)

$$v_1 + v_3 + v_5 = v_2 + v_4 + v_6 + v_7 + v_8;$$

and when $A' > 90°$, if the value of v_7 is always of one sign,

$$v_1 + v_2 + v_8 = v_3 + v_4 + v_5 + v_6 + v_7;$$

which two results express the property enounced in the Prize question. The latter result is always true so long as e_7 is outside the 3 given circles, as we have supposed it to be in

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(11). But it can be shown analytically that the value of v_7 is not always of one sign, for $A' > 90°$, and geometrically that e_7 is not always outside the given circles.

$$\pm v_7 = \frac{\frac{n_1^2}{a}+\frac{n_2^2}{b}+\frac{n_3^2}{c}-\frac{\sin A}{a}}{u_1^2+u_2^2+u_3^2-1-2\underset{123}{uuu}} = \frac{1-\frac{c}{s_2}\cos^2\theta_7}{s-\frac{ac}{s_2}\cos^2\theta_7}.$$

The denominator of this vanishes when $A'=90°$; and the numerator vanishes when $2=\tan\frac{A'}{2}+\tan\frac{B'}{2}+\tan\frac{C'}{2}$, or when $A'=2\tan^{-1}\left\{2-\tan\frac{B'}{2}-\tan\frac{C'}{2}\right\}$, an angle $>90°$, and always assignable when either the acute angle B' or C' is given, and one which is greatest when $B'=C'$, which gives $\tan\frac{A'}{2}=\frac{4}{3}$. Moreover $\pm v_7$ is never $\frac{0}{0}$; for that would require $\cos^2\theta . c=s_2=\frac{s_1 s_2}{a}$, or $a=b+c$.

Further, it is plain geometrically that the two hyperbolic branches that are not about A, whose intersection gives the point e_7, will not always intersect, and that when the 3 given circles have a common tangent, this intersection is at an infinite distance, giving the radius $\frac{1}{v_7}=\infty$. As A' increases, the two branches about A have two intersections. In this case equation (11) is incorrect, and must be written

$$\frac{1}{v_7}=a+Ae_7=b+Be_7=c+Ce_7;$$

and we find e_8 and e_7 by substituting both values of $\sin^2\theta$ (15) in equation (13). This gives the same result as before, except that $\pm v_7$ is now $+v_7$, and we obtain

$$(22)\qquad +v_8+v_7=\frac{2\left\{\frac{n_1^2}{a}+\frac{n_2^2}{b}+\frac{n_3^2}{c}\right\}(u_1^2+u_2^2+u_3^2-1)-4\underset{123}{uuu}\frac{\sin A'}{a}}{(u_1^2+u_2^2+u_3^2-1)^2-4u_1^2u_2^2u_3^2};$$

whence by (10) and (22)

$$v_1+v_2+v_7+v_8=v_3+v_4+v_5+v_6,$$

which is the relation existing among these reciprocals for all values of A' greater than

$$A'=2\tan^{-1}\left\{2-\tan\frac{B'}{2}-\tan\frac{C'}{2}\right\}.\quad \text{Q. E. D.}$$

One of the solutions of this Prize question, which was for want of space precluded from insertion in the L. and G. Diary for 1846, appears in the *Mathematician*, vol. ii., p. 69. (March, 1846). From what precedes it is clear, that the theorem (F) of that solution, page 73, which enunciates the property asserted in the Prize question, cannot be generally true.

PRIZE QUESTION, LADY'S AND GENTLEMAN'S DIARY, 1846.

Three equal spheres in contact with each other rest on a horizontal plane; an equal sphere is placed upon the other three. Determine the conditions of equilibrium and the relations of friction between the spheres, and each sphere and the plane, so that all the points of contact may begin to slip at the same time.

It is with the greatest deference to the judgment of mathematicians that I venture to state, in a tone by no means positive, my reasons for questioning the correctness of the solution of this problem, which is given in the *Lady's and Gentleman's Diary* for 1847, page 70.

R is there put for the normal pressure at the contact of the upper with the lower sphere; θ is the angle between the normal and the vertical; $R\cos\theta$ is put for the vertical effect of R; and $R=\frac{1}{3}W$, W being the weight of a sphere, is the value deduced. Now, in the state of equilibrium, the whole vertical pressure, R_1, at the contact of a lower sphere with the plane, can be neither more nor less than $W+R\cos\theta$; *i.e.* $R_1=W+\frac{1}{3}W\cos\theta<\frac{4}{3}W$.

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This being true at all the three contacts with the plane, it follows that four spheres, piled as in the question upon a flat scale, will weigh less than if placed side by side upon the scale!

It is true that $R_1 = \frac{4}{3}W$ is also deduced in the solution, but that would equally be deduced by the same process, whatever values might be put for R and F in the equations. $R_1 < \frac{4}{3}W$ is a valid deduction from the reasoning, which cannot therefore be sound, since contradictory conclusions may be drawn from it.

I cannot help thinking that the following is the proper mode of treating the question:—

We may confine our attention to one of the lower spheres, and a third part of the upper one, which we may suppose constrained to move without rotation in the vertical through its centre. Let O be that centre, O_1 that of the lower sphere, W the weight of a sphere, P the point of contact between the upper and lower sphere, Q that of the lower with the plane, μ_1 the co-efficients of friction between the spheres, and between the sphere and the plane; θ the angle between OO_1 and the vertical, and mPm' a tangent at P in the vertical plane through OO_1 m' being between P and the horizontal plane.

If we imagine an infinitely small motion of O vertically downwards, and of O_1 parallel to the plane, P on the lower sphere will be removed through an infinitely small arc towards m', and on the upper towards m through an equal arc, while Q makes an infinitely small motion on the plane. That is, the spheres will slide on each other in opposite directions while Q slides on the plane, through spaces infinitely small. By a well-known law of motion, the friction of either sphere sliding upon the other is the same, whether that other slides or not. The acting forces will be, besides gravity and the normal pressures R and R_1 at P and Q, a friction in the direction Pm retarding the upper sphere, and an equal friction in the direction Pm', besides that on the plane, retarding the lower. The equal and opposite frictions being resolved vertically and horizontally, the vertical components destroy each other; the horizontal effect of that in the direction Pm, and the moment of the same force about O, are destroyed by our first supposition. The moment of the force in the direction Pm' about O_1, and the horizontal component of that force, act upon the lower sphere. The normal pressure $R = \frac{W}{3}\sec\theta$, and $R_1 = \frac{4}{3}W$. The equations of equilibrium of the lower sphere are the two following:

$$\frac{W}{3}\sec\theta\sin\theta - \mu\frac{W}{3} - \frac{4\mu_1}{3}W = 0 \text{ for the horizontal forces,}$$

$$W\left(\frac{\mu}{3}\sec\theta - \frac{4}{3}\mu_1\right) = 0, \text{ for the moments about } O_1;$$

$$\text{hence, } \mu = \tan\frac{\theta}{2},\ \mu_1 = \frac{\mu}{4}\sec\theta,$$

$$\frac{\mu}{\mu_1} = 4\cos\theta = 4\frac{\sqrt{2}}{\sqrt{3}},$$

which I believe to be the true relation, and not $\frac{\mu}{\mu_1} = 4$, as in the Diary, 1847.

One word about the Prize question for 1844. The solutions that appeared showed that it was not comprehended, and it is not likely to be soon answered. A particular case, the general solution being despaired of, was proposed in the Diary for 1846, Question 1760:—

"*How many triads can be made out of* n *symbols, so that no pair of symbols shall be comprised more than once among them?*"

The gentlemen who have attempted to answer this partially in the Diary for 1847, do not offer their communications as solutions of the problem. Few men are sufficiently at leisure, perhaps I should say sufficiently silly, to labour at such impracticable, and, as I fear, unprofitable riddles. A correct solution, which from its length I could not venture to offer to this Magazine, will appear in the next number of the *Cambridge and Dublin Mathema-*

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tical Journal. The result is as follows: Let Q_n be the greatest number of triads required:

Let n be $6m \pm t$; $t < 4$; let $k = \frac{m - 2^r}{2^{r+1}}$; m, t, k, r, being integers ≥ 0:

Let $S_x = \frac{a_1^x + a_2^x + \ldots + a_6^x}{6}$; $a_1 a_2 \ldots a_6$ being the roots of $z^6 - 1 = 0$. Then

$$Q_n = n.\frac{n - 2^{\cos^2(\frac{1}{2}n\pi)}}{6} - \frac{1}{3}\left\{ S_{t+1}(6k+4) + S_{t+2}(3k+1) \right\}.$$

Croft Rectory, near Warrington, Lancashire,
April 27, 1847.

SHORT METHOD OF FINDING LOGARITHMS.—DECIMAL NOTATION.

Sir,—I beg to send you a few remarks on the most expeditious mode of finding from the large tables of logarithms, such as Hutton's or Babbage's, the logarithms of any number, or the number to any logarithm, which, if not new to all, will be, I believe, to most of your readers.

It is founded on the fact that, of 5 things, as lines or columns, there being a central 1 and 2 on either side, it is immediately seen which is 1st, 2nd, 3rd, 4th, or 5th, counting from either end.

Tables of logarithms are divided by a black vertical line into two divisions of 5 vertical columns in each, the first being from $\overline{0-4}$, the second $\overline{5-9}$. Horizontally the numbers are in groups of fives, with either a blank space or a black line between each group. Suppose a black line between the 2nd and 3rd group of fives—4th and 5th, 6th and 7th, 8th and 9th—there being blank spaces between the intermediate groups, we shall then have the page divided horizontally by black lines into 5 sets, of 10 log. in each, which are subdivided into 2 sets of fives by the blank spaces. Now, for the application to the finding the log. of 57·46·54, I turn to that opening of the table which contains the numbers

$$\overline{5700 - 5800};$$

as in all the ordinary tables there are 50 log. in each page, it is evident that, as the 3rd and 4th figures are 4 and 6, it will be found in the left-hand page; as it is in the 5th set of tens, and the 2nd in the last division of that set, I can at once place my finger on the horizontal row which contains the log. required. The 5th figure being 5, it will be the 1st to the right of the vertical black line, upon which place the finger whilst noting the proportional part corresponding to the 6th figure, which can be added mentally to the log. of the 1st five. In finding the number corresponding to a given log., I find the tabular log. next less than it; I place my finger on it, mentally find the figures corresponding to the difference from the list of proportional parts, which I write down first, and then the 1st five figures of the number—the 1st two from the heading of the page, and the 3rd, 4th, and 5th from that relative position of the next less tabular log., vertically and horizontally.

It would somewhat facilitate the operation if the two 1st figures of the number were printed in distinct type, half way down the side of the page, that the eye might catch them without travelling to the top of the page.

It may be said, that tables not being divided in the manner described, the method is useless. I for some time endeavoured to find tables so divided, without success. I procured Babbage's, which were like the others in this respect; but in the preface, computers are recommended to rule the lines for themselves, as it was difficult to print them. This I have done.

I have found difficulty in describing the matter clearly; but if read with logarithmic tables before the eye, it will be understood, and if acted upon, be a great saving of time.

I also submit that some time will be saved in applications of logarithms, and no correctness sacrificed in very many cases, if the characteristics are entirely neglected—as the increase or diminution by 1 multiplies or divides the result by 10; therefore, in questions where a mistake to such an extent could not be made in estimating the value of the significant figures, they may be omitted.

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Much has been said lately about the decimal notation for monies. There can be no doubt of its superiority. One defect of the present system in accounts, is the great space necessary to keep the various denominations distinct. This might be avoided in the following manner, in which the same amounts are written in the ordinary and in a new method:

$$\begin{array}{rcl} 2 \cdot 4 \cdot 2 & = & 2 \cdot 42 \\ 3 \cdot 14 \cdot 5 & = & 3 \cdot \bar{4}5 \\ 2 \cdot 0 \cdot 6 & = & 2 \cdot 06 \\ 2 \cdot 12 \cdot 10 & = & 2 \cdot \bar{2}\bar{0} \\ \hline \pounds 10 \cdot 11 \cdot 11 & = & \pounds 10 \cdot \bar{1}\bar{1} \\ \hline \end{array}$$

W. O.

Islington.

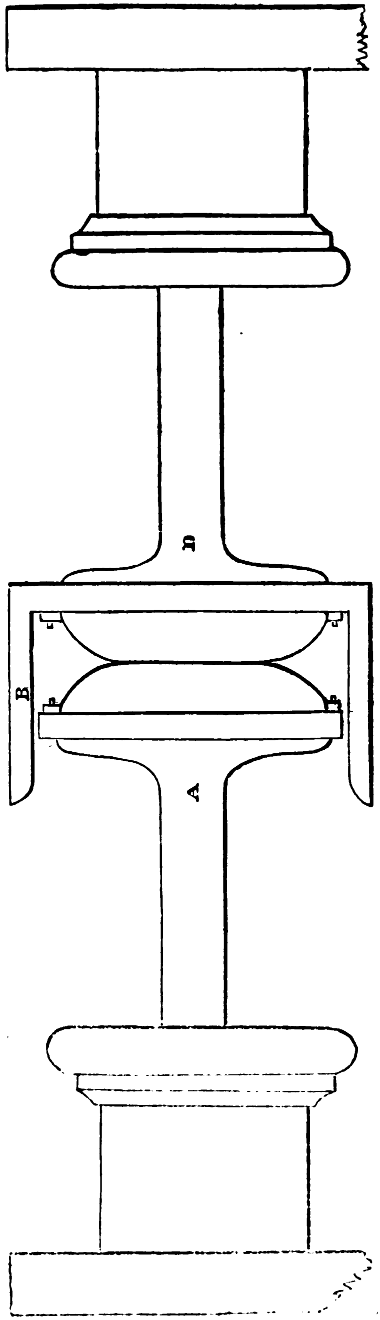
ON THE PREVENTION OF RAILWAY ACCIDENTS. BY SIR GEORGE CAYLEY, BART.

Sir,—Early in January a fearful accident occurred to the Brighton "Express Train" near Godstone. The axle of the first carriage broke; the carriage, of course fell down, and was dragged bumping along, partly on the rail and partly ploughing up the road way for nearly a mile: luckily, though this happened on an embankment 20 feet high, the train reached Croydon without any serious injury to any of the passengers.

As it is now admitted, that every strain applied to iron injures its adhesive power, we may expect, that without great attention to the renewal of the axles of railway carriages within the proper limits of time to ensure safety, an increasing per centage of such accidents will in future take place.

The reporter, who noticed this accident in the *Times* newspaper of the 28th of January, states, that the carriage to which this wheel belonged appeared to be a *very old one.*

As this accident, though luckily unattended by any serious consequences in this case, is of a very dangerous character; and even with the greatest precaution, it may occur from some invisible defect in the metal of a new wheel—I wish to suggest, for the consideration of our civil engineers, whether the danger, arising from the breaking of an axle, or any other part of a wheel, may not in a great measure be obviated by the following arrangement of the buffers:



Suppose A to be one of the front buffers of a carriage, then let a cylindrical plate of wrought-iron with a circular bottom C, be fixed to the hind buffer D of the next carriage, so as entirely to contain the head of the buffer A. This construction will not interfere with the appropriate elastic action of the buffers; but when the carriages are properly secured together by the screw shackles, should an axle or wheel be broken in either carriage it would be sustained in its horizontal position; indeed, were both front or both hind wheels in either carriage broken, the effect would be the same, and the carriages would proceed any distance without the passengers being aware of the accident.

Many plans have already been suggested for obviating or diminishing the dangers of railroad conveyance, but several of these are only applicable to entirely new constructions of the rails and carriages; and are thus rendered a dead letter for the present: but this plan might be immediately adopted with little cost; and is therefore worthy of serious consideration.

The shanks of the buffers are from 2½ to 3 inches in diameter, and have at most a foot of leverage, or projection beyond the frame in which they slide; they are therefore competent to support one ton, which is the weight pressing on the wheel of a carriage for passengers. These shanks might readily be made stronger if required, without any alteration in the general structure of the carriages. It should here be observed, that although, when the weight of a carriage, being four tons, presses alike on each wheel, they have to sustain one ton; yet, if one wheel be wanting, the carriage has its centre of gravity on the line of the hypotheneuse of the triangle formed by connecting lines to the treading point of each wheel, and thus only requires to be balanced by a very slight sustaining force which thus distributes the whole weight upon the remaining three wheels equally. Several methods of applying this principle of locked buffers may be suggested. A strong central pin and a hole in the centre of the opposite buffer would be a most simple plan for a new construction; but these are matters for future consideration. One strong central buffer, would perhaps be a better construction than the two in present use; as in passing curves its action would be more uniform; but it would be inconvenient, with the present shackles, for uniting the carriages.

I am, Sir, your obliged and obedient servant, GEORGE CAYLEY.

20, Hertford-street, March 1, 1847.

From the same.

Sir,—I am sorry to find that my promised communication has been delayed till these terrible railway accidents have again called my attention to the subject; I now send you the original paper from which I showed you the rough sketch of the locked buffers.* Had this instrument been in use the lamentable accident at Wolverton might probably have been prevented; for it appears, that in consequence of the sudden rebound of the first portion of the train meeting in the sixth carriage with the terrific momentum of the greater portion behind, one buffer slipped up over the other, by which the carriage was completely lifted, and several persons were suffocated by its weight.

There is another advantage attending these locked buffers—they will modify to a great extent the lateral plunging of each carriage against the rails, thus making the whole train, by the more intimate connection of its parts, a general guide and support to itself.

There is also a curious property of this construction with respect to deficiencies in the sleepers or rails; suppose that a ponderous sixteen ton engine may have broken down a rail, or even part of a bridge not longer than one carriage and have still continued its course, all the following carriages, but the last in the train would be suspended by their buffers over the gap without jolt or hindrance; and though the last carriage would feel it, its front wheels would be safely deposited on the rails, and the hinder ones have the best possible chance of reaching them also.

It appears from an admirable letter in the *Times* lately, signed as by a practical "Railway Engine Driver;" which will, I hope, call attention to the subject of railway dangers in the quarters from

* Sir George Cayley showed us the plan of these locked buffers sometime before the date of the preceding letter, and was induced by the favourable opinion we expressed of it to promise us the description of it, which we have now the pleasure to lay before our readers. ED. M. M.

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which amendment alone can come, that most of these terrible accidents might be avoided by the full application of the breaks, but that sufficient officers for that purpose are wanting. In God's name let these forthwith be supplied; but human attention is scarcely adequate to the continuous watchfulness that can stay an accident within the few seconds that may be available for that purpose.

Mechanical agency may surely be made dependent on the instant the steam is cut off, for effecting the full application of the breaks; when the train is no longer pulled forward, each carriage is only borne along by its own momentum. The pull of the engine upon every four tons' passenger carriage is, in round numbers, about one hundred pounds. Suppose this pull of 100 lbs to be applied in such a manner as to liberate the wheels of the carriage from a break kept in constant action by a strong spring movement with leverage; then, the instant the pull of the engine ceased all the breaks would be in action. If the mechanism be so arranged, that whether carriages be moved backward or forward, the breaks would be disengaged, no inconvenience would be found in handling the carriages at the stations when forming trains. Indeed these breaks ought to be capable of being suspended from action at the will of any officer, and only free to perform their duty when placed in a train. They must also be so modified as to allow three or four seconds to pass, after the engine ceases to pull before the break is in action; otherwise, each vibratory motion of the train might produce obstruction and inconvenience. All these matters are strictly within the ordinary range of mechanical agency, and would readily be adapted to the present carriages if our talented engineers were desired by the *proper authorities* to effect them. Till then they will sleep, unless we are aroused by some mighty hecatomb of the slain to terrify us into doing our duty. Before I conclude, let me once again urge that most palpable of all improvements, and that which is most shamefully neglected: to have as the last carriage in every train one entirely constructed as a wholesale buffer to all the rest—say a series of well-packed elastic mattresses 20 feet long, placed on what is now called a telescope sliding frame with wheels. If the lock-buffers here described be adopted, this is necessary more effectually to complete the plan, and give the fullest scope to its beneficial effects. Let me add that the present system of placing second or third-class carriages in the rear, to serve by being "smashed up" with the bones of their passengers as buffers to those of the first-class is most disgraceful and inhuman. The lives of all men should be considered of equal value. Our laws hang a man as readily for killing a peasant as a duke; and it becomes doubly abominable, because a poor man cannot afford to pay a first-class price, that his life should be put in jeopardy in addition to his other hardships.

I am, Sir, yours, &c.,

GEORGE CAYLEY.

BIDDER'S TABLE APPLIED TO THE COMPUTATION OF LAND FOR RAILWAYS.

Sir,—One important application of Bidder's Table appears to have escaped its author, viz., the facility it affords for computing the area of the land necessary for a railway.

If your readers will be good enough to turn to fig. 1, No. 1195, page 8—I need not trespass upon your space with a fresh one—Let RSQP therefore be the section of a portion of a cutting: now if the breadth of the slope be equal to its depth (or speaking technically, if the cutting have a slope of 1 to 1) we shall have $RS = Ss$, and $PQ = Qq$; and therefore the tapezoid $SsqQ$ is equal to the tapezoid RSQP, consequently the land required for each slope $= RQ$. Doubling this we get the area required for the two. To bring the table into play, we must put $PQ = a$, $RS = b$, and $SQ = 66$ feet. Hence, by the ordinary rule for a tapezoid we have

$$RQ(=Sq) = 66\left(\frac{a+b}{2}\right) \text{square feet,}$$

$$\frac{11}{3}(a+b) \text{ square yards.}$$

Now the *coloured* number in Bidder's Table $= \frac{11}{9}(a+b)$; we have, therefore, merely to multiply this by 3 to obtain the area required for each slope, or by 6 which gives it for both.

Again, let RS and PQ be increased or diminished in any given ratio, and we have RQ manifestly increased or di-

minished in the same ratio. Consequently if RS and PQ have respectively to Ss and Qq the ratio 1 to n, we have

$$RQ \times n = Sq.$$

The area of the central part is soon disposed of. It is obviously the length of the railway multiplied by its breadth.

There results, therefore, the following rule:—Multiply the content of the central part of each cutting and embankment (as taken from the tables before it has been multiplied by the width of the base) by the ratio of the slope, and add all these products into one sum, which we will call M.

Multiply the length of the railway in yards by the width in yards required for the base, fencing, &c., and call the product N.

Then $\frac{6M+N}{4840}$ = area required in acres.

Allow me to add, that I fully concur in the justice of your concluding remarks at the foot of p. 9, vol. xl., and therefore do not advocate the use of Bidder's Table when excavations have actually to be *paid* for. But when it is remembered that the preliminary surveys for a railway have frequently to be carried through the property of a landowner hostile to the project, and that railway surveyors are then placed in the awkward position of *trespassers*, it is plain that an extensive system of "cross-sections" is out of the question. In these cases Bidder's Table is most useful. When, however, the bill has been obtained and the engineer is backed by the powers of an act of parliament, the *closest possible* approximation to the actual quantity of earthwork ought, in justice to all parties, to be made. A good formula for this purpose is a desideratum, and I am happy to find the subject is exciting the attention of Professor Davies. It could not be in better hands.

I am, Sir, yours, &c.,
ALEXANDER COLVIN.

THE TRANSGYRATOR.

Sir,—I beg to submit to the consideration of your readers the following substitute for a bridge. In some situations it appears to possess advantages over the plans generally adopted.

The accompanying figures represent an elevation of the machine; *a a*, are two light cast-iron radius rods (one only is visible in the sketch), which *gyrate* on the shaft γ; between these two rods a space of about 3 feet is left; they are connected at the top by the spindle ζ, from which spindle is suspended the frame δ δ by the rods ν ν (one of which is not seen). As persons cross on this frame, perhaps it may not inappropriately be termed the "transit."

A person about to cross is supposed to be standing on a bank or artificial platform χ χ, from this he steps into the transit δ δ. By pressing gently against the stationary rail o, at the same time steadying by the banisters κ κ, the equilibrium of the apparatus is destroyed, and the rods *a a* incline over the stream v v, until they come into the direction θ θ, the transit, which by its gravity has preserved a perpendicular direction. Having then reached the opposite shore, the spring catch ψ immediately closes on the pins ι ι, fixed in each side of it, by which means it is retained until the person has stepped out; the handle λ being then raised relieves the transit, and the weight β restores it to its perpendicular position.

That the person crossing may not receive an unpleasant shock on reaching the opposite shore; the weight β is supposed to be nearly equivalent to the lightest person crossing. The question arises, How are heavy persons to cross without a severe concussion? I think this objection would be obviated by making the weight β broad, by which means the water would offer a considerable resistance to it, which resistance might be further increased to any extent by partially confining the water in the recess behind the weight, by masonry or otherwise, as shown by the line ξ ξ, and thus the transit would land steadily whatever weight might be upon it. A pad might also be affixed to the under side of the transit if necessary.

The term Bridge does not seem to apply to the above plans; therefore, as persons would be so peculiarly *turned* over, I have given it the name of *Transgyrator*.

The greatest advantage that I imagine would be gained by this plan, is in places where the arched bridge cannot be erected. When the number of passengers is very great, or when animals or carriages have to cross, I am aware the draw-

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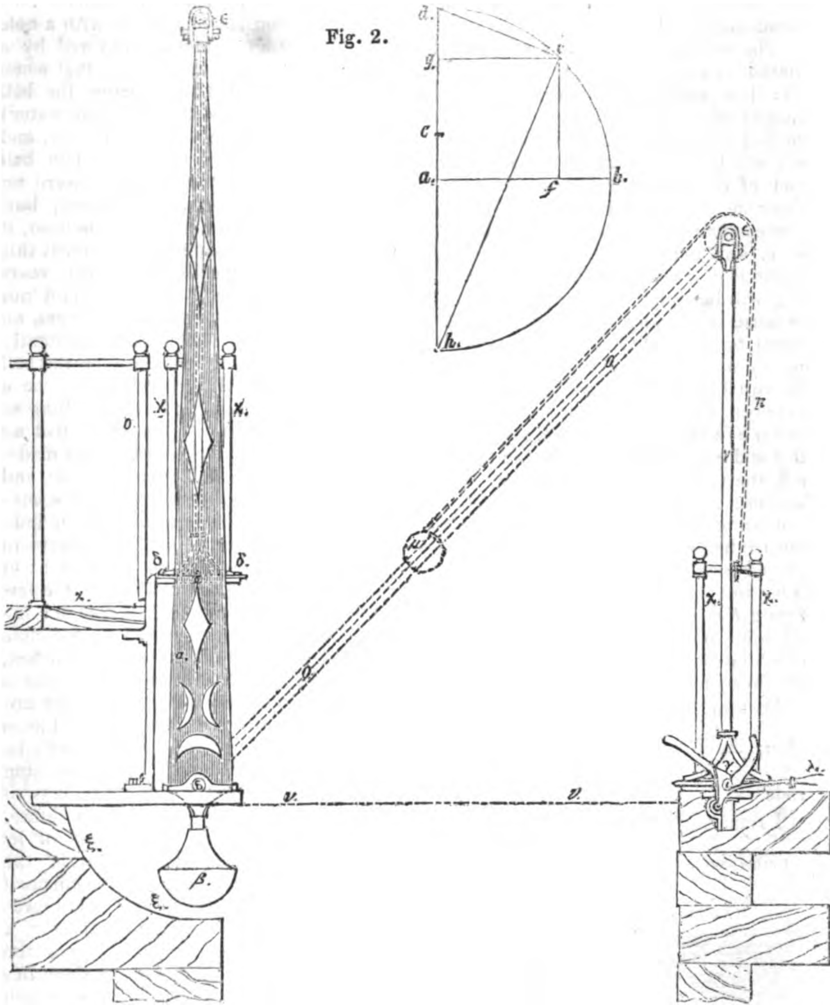
bridge is indispensable, but in cases in which only foot passengers require to pass, the labour of turning the bridge (for they often work stiffly), as well as attention and loss of time would be avoided.

Fig. 2.



In parks, although only for ornament, and the pleasantness of the motion, perhaps it might be suitably introduced in some cases. It will be observed, that from the gyrator not taking a return passenger, one would require to be erected on either side of the stream. A single one might be used for a private crossing in the following manner. The rods *a a*, being round, as shown by the dotted lines θ θ, two balls μ can be slid up and down them by means of the cords π—these balls being at the bottom. The person crossing having unlocked the transit from the fixed rail *o*, draws one or both of the balls μ upwards, and thus adds to his weight until he descends gently on the opposite side; there he secures the transit by locking down the handle λ, on returning, by letting down the weights μ μ nearer

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to the centre γ. The weight β would be proportionally increased until it exceeded the weight of the person; the radius rods *a a* would thus be restored to the perpendicular position.

The length of the radius rods may be found by the following method (see fig. 2): The middle of the river *a f*, and the height of the platform *a c* being given to find the weight of the radius rod *a d*, *d c* will be the length of the suspension rod of the transit. From the centre *a* describe the semicircle *d b h*; draw *e f* perpendicular to *a b*, of equal length with *d c*, and touching the circle in some point at *e*, *d e* will be the arc described; *d g* will be equal to the radius rods *a c*, because *a g* being equal to *e f* is also equal to *d c*; therefore the remaining part *g d*, is equal to *c a*; and *e g* will be equal to *a f*, because perpendiculars between the same parallels are equal: but *a c* and *a f* are given; therefore, *d g* and *e g* are also given; join *d e* and *e h*, the angle *d e h* will be a right angle, because inscribed in a semicircle, and *g e* being drawn from the right angle perpendicular to the base will be a mean proportional between the lines *d g* and *g h*: but *d g* and *g e* are given, therefore *g h* is also given; but the sum of *gh* and *g d* equals the diameter *d h*, half of which diameter is the radius *a d* which was to be found.

Formula, $ca : af :: af : gh$;

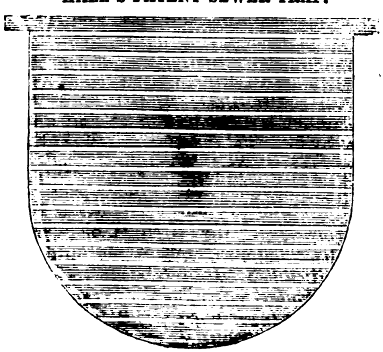
then, $\frac{gh + ac}{2}$ = length of the radius rods.

I remain, your obedient servant,

UTILITAS.

Rotherham, June 17, 1847.

HALE'S PATENT SEWER TRAP.



Dear Sir,—I understand the Society of Arts has awarded a gold medal to the inventor of an apparatus for preventing the escape of effluvia from drains. This apparatus consists of a vessel with a hole in the bottom, which is covered by a ball; and the presumption is, that when the vessel is filled with water, the ball (being specifically lighter than water) will rise, allow the water to escape, and again sink to the bottom. The ball would undoubtedly rise if there were no hole in the bottom of the vessel, but, because there is a hole in the bottom, it will not rise. I happened to invent this same kind of "stink-trap" two years ago; and, though I knew it would not act perfectly when applied to sewers, on account of the solid matter constantly interposing and settling between the ball and its bed, I thought it might be a valuable approximation to the thing so urgently required. I therefore had an apparatus of the above description made, placed a wooden ball over the hole, and filled the vessel with water. I was surprised to see the ball remain at the bottom, and it resisted my endeavours to move it in proportion to the weight of water above it. Having raised it a few inches above the hole, I released it; instead of floating, it rushed to the hole with the velocity of the water. In fact, this vessel filled with water, acts like a little whirlpool, carrying everything under its surface; and if anything like a ball fitting the hole be put in, it will be forced to the bottom, and remaining there, prevent the further progress of the water. This apparatus is, therefore, entirely useless for the purpose of its invention. In my experience of the London sewers, I find no trap so effectual as the patent India-rubber one represented in the accompanying sketch. A thin sheet of India-rubber covers the aperture to be trapped, and the sheet has metal bars attached to the back, which form a series of hinges, so that the valve is only raised to the surface of the flowing water, and consequently there can be no emission of foul air during the egress of water—an advantage peculiar to this trap alone. I am, Sir, &c., J. L. HALE.

8, Well-street, Hackney, June 15th, 1847.

[The invention, referred to by our correspondent, as having obtained a prize from the Society of Arts, is the "Hydrostatic Valve" of Mr. F. Abate, "Neapolitan civil engineer and architect." Mr.

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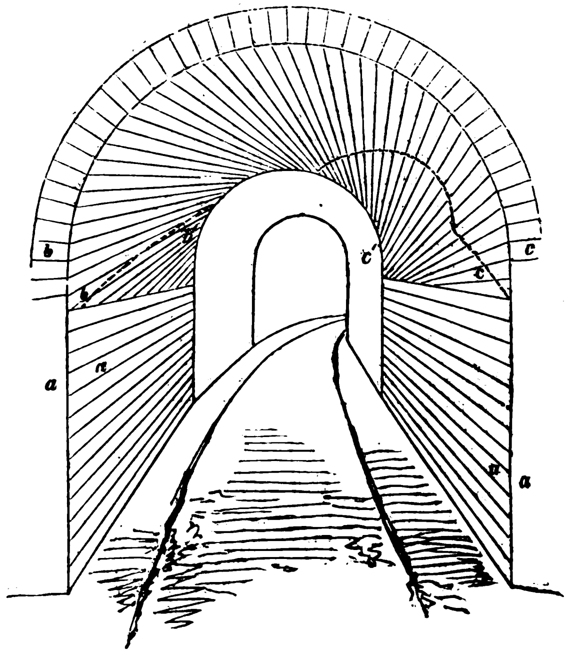
Hale's description of it accords exactly with that given by Mr. Abate himself in a circular, a copy of which he has sent us. It seems pretty evident that neither Mr. Abate nor the Society have ever tried this apparatus.—ED. M. M.]

FALL OF THE SOUTH EASTERN RAILWAY ARCH OVER GREAT RUSSELL STREET.



Sir,—It is but last week that you told us that all railway bridges ought to be built of stone, or brick, because an iron bridge had fallen. What is to be said now that a brick one has come down? The materials employed in its construction were good, and will most likely be used in re-constructing it. The piers were good—the very fact of their never yielding the least observable distance to the arches which were on each side of the one that fell, proves them to have been so. The workmanship was good; I have had almost a daily opportunity of examining it, and saw it not five minutes before it fell, nor more than fifteen minutes after it came down. In fact, the binding together of the brickwork, and the overhanging of the ruins, were such, that it was almost terrific to see so many workmen under it clearing away the fallen mass. And how rarely have we ever heard of an arch falling when the centres have been struck?* There is one thing to observe, however, and it is worthy of note, both by engineers and contractors of such arches, that it was what is generally termed a skewed arch. The other arches had their centres struck as early after being built as the one that fell, but they were not of the skew class. Is it not, then, reasonable that we should look for the casualty having arisen from that source? Indeed, upon examination of the ruins of the structure, as it stood a few minutes after the circumstance took place, I was not at all

* From the evidence adduced at the inquest on the bodies of the persons killed (held subsequently to the writing of this letter), it appears that the centres were still standing at the time of the accident—that a horse and cart in passing became entangled with, and threw them forcibly over against one side of the arch—and that this was, in all probability, the real cause of the disaster. We have ourselves little doubt that, but for this horse and cart incident, the arch would have stood just as well as those beside it.—ED. M. M.

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left in doubt in the matter. The result proves clearly that skewed arches are not *really* so strong as the common arch. That it fell while the lime was in an unset or uncompacted state, goes to show us that the circumstances which cause a skewed arch to stand or fall, are not at a very great distance apart from each other. This will be best understood by a reference to the figure: *a a* are the piers, *b* and *c* the courses of brick constituting the arch (the observer is considered to be standing in the centre of the arch, a little before it). According to the rules generally followed in constructing them, the line of bricks forming the arch on the one side, *b*, are inclined downward; those on the other side, *c*, are inclined upward, that is, on the side of the bridge next to the observer—on the opposite side of the bridge the reverse is the case. It will at once be seen that the only thing which prevents the bricks at *b* from sliding down the inclined plane upon which they lie is, the friction subsisting between the superincumbent surfaces of the one row and the upholding surfaces of the other row. The friction between the surface of brick or stone, is pretty considerable; but if a body of wet or unset lime is placed between them, as was the case in this instance, that friction is greatly reduced, and as a natural consequence the bricks at *b* must slide outward, and the whole incumbent structure tumble down along with it. The fracture immediately after the fall presented somewhat the appearance indicated by the dotted lines, because the bricks at *c'* were prevented from sliding outward by the building of the Greenwich branch line immediately behind.

The conclusions to be drawn are obvious: 1st, That there is a certain degree of inclination which may be given to the line of bricks (this depends upon the angles at which the one line of way passes the other) at which the friction subsisting between the surfaces will give way. 2nd, That that angle will depend upon the incumbent weight placed upon the arch.

It follows from the first of these conclusions that when the friction is reduced, as was the case in the present melancholy instance, by the lime being yet in a wet or unset state, the risk of falling is greatly increased, and in a ratio perhaps much beyond what former experience in skew bridge building, or rather falling, has pointed out. And, as a general conclusion, we must infer, that the ratio of durability, safety, and stability, increases by very rapid strides the moment we begin to incline the courses of brick or stone, of which arches are formed—that is, in fact, to make skewed arches; a fact well worthy of being noted in the railway engineer's memorandum book, as well as impressed upon the minds of contractors and bricklayers. I am, Sir, yours, &c.,

S. B. M. (Engineer.)

P. S.—I have just seen it stated in a public paper that the workmanship was very bad; this I believe to be a gross slander of some person ignorant of such operations. I say this without any reference to the contractors, with whom I have not the pleasure of having even the slightest acquaintance.

REMARKS ON THE USE OF MATHEMATICAL KNOWLEDGE TO ENGINEERS, AND HINTS TO THOSE WHO HAVE NOT THE BENEFIT OF A TUTOR.

(Continued from p. 584).

These principles, or laws of motion, are sufficient (with the aid of geometry and the differential and integral calculus) for determining the motion of any particle of matter or rigid body when all the forces acting upon it are known. But the only forces which are generally given in any problem are the "external" ones; such, as for instance, the pressure on the piston of a steam engine; there being an unknown process going on in the interior of bodies by which the external forces are transmitted and modified, and which process we know scarcely anything about. So long as we are treating only of the motion of "points," or of bodies, considered as mere particles, the motion of the various parts of the body amongst each other being neglected—we have no need of any further principles than those named. But when we take a solid body, and consider, not only its motion as a whole, but that of its various parts, seeing that the interior mechanism is unknown to us, we must devise some means of doing without it. For example, the planets are so distant from us, that the only part of their movements with which we are at all concerned, is that large and visible motion by which we see them change their places in the heavens. The attraction of the sun and other planets, produces besides this an

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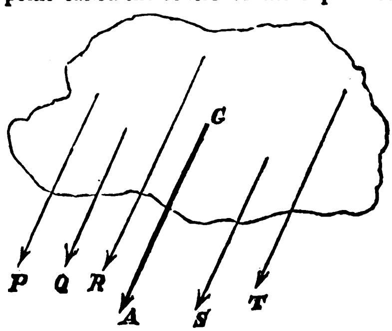
infinite number of other motions, such as revolutions round their axes, tides in their oceans, &c. &c.; but to these *minutiæ*, for such they are to us, we pay no attention whilst engaged in tracing out their orbits round the sun. Hence, the great mass of physical astronomy is altogether unencumbered with the consideration of those unknown forces which render all the more familiar phenomena of our daily experience so difficult to calculate. Each planet is considered as a mere point (wherein, however, the whole quantity of matter of which the planet consists is supposed to be condensed), on which a number of forces are acting, the magnitude and direction of each being known. It is a comparatively easy task to determine the resultant motion, therefore, in this case; and hence, physical astronomy, though dealing with a most sublime subject, is nevertheless a much easier and more certain science than the mechanics of engineers or every day life.

Amongst those subsidiary considerations which enable us to calculate the motion of any body or system of bodies, whilst ignorant of the exact mode in which force is transmitted from one part of the body to another, or from one body in the system to another; the most important are those relating to the centre of gravity, or, to give it its more general name, the centre of parallel forces. In every body, or system of bodies, any how connected together, there is a point which may be taken as the representative of the whole body or system when we are considering the motion *as a whole*, and which also assists us very much when considering the motion of the parts amongst each other; for, with regard to the first question, this point moves precisely in the same way as if the whole system or body were condensed into that point, and all the forces, instead of being scattered over the various parts, were each brought to act immediately on this point—each retaining its original direction and magnitude. Now, the motion of a point is always easy enough to determine, and therefore the motion of the centre of gravity is also easily found. With regard to the second question: The motion of the various parts amongst each other, or the general motion of rotation, is exactly the same as if this point, the centre of gravity namely, were *fixed*. To these two theorems reference is sometimes made under the name of "the Independence of the Motion of Translation and Rotation,"—that is, the general onward motion of the whole does not interfere with the rotation of the system which takes place round the centre of gravity, as if that point were absolutely at rest instead of moving onwards with the rest. As this theorem is perhaps the most important of the auxiliary principles in mechanics, and, moreover, admits of a very easy proof, I shall proceed to give it. It must be recollected, that the centre of gravity, or of parallel forces, is that point at which a single force, whose magnitude equals the sum of all the parallel forces, and whose direction is the same as theirs, must be applied in order to counterbalance them (if applied in the opposite direction to theirs,) or if applied in the same direction will be in every respect equivalent to them; so that they might all be removed without altering the body's motion or state, provided this one were left to represent them. Thus, if P, Q, R, S, T be forces acting on a rigid body, and G be the point called the centre of these parallel



forces; then, if a force equal to $P+Q+R+S+T$ were applied in the direction GA it would exactly represent all the former forces; or if applied just in the opposite direction, then it would just counteract all the others.

The centre of *gravity* of a body is the centre of all those parallel forces which the earth's attraction exerts on it; wherever there is a particle of matter there is one of these parallel forces; they are all considered parallel to each other, because they all meet in a point so distant (viz., the centre of the earth), as to be to all perception parallel, and if the body be divided into particles of the same size the forces will also all be equal. It should

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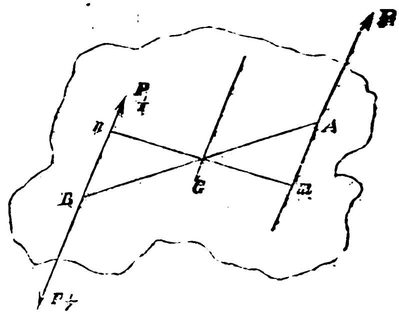
not be forgotten, however, that the centre of *gravity* is only a particular case of the general one where the forces are any whatever, and not the attraction of the erath alone.

Suppose now any body be in motion, no matter in what shape the body may be, or what the nature of the motion. The centre of gravity, as part of the body is moving onwards, and the body is moreover revolving and rotating in all sorts of ways. The forces which produce the motion may be either the pressures exerted by means of ropes attached to it, the attraction of a number of magnets, or any thing whatever. We shall obviously simplify the calculation of the motion, if we can reduce the question into the consideration of the two others, namely, first find what will be the motion of the centre of gravity, and then what will be the motion *round* that point. Now, any force applied to this point, is by the very nature of the centre of gravity, equivalent in all respects, and produces exactly the same motion, as a number of forces equal and parallel to each other, and applied to each particle of the moving body or system, their common direction being parallel to that of the force which we suppose to be applied to the centre of gravity, and their whole sum equal to that force. Since then, if these forces be so applied every particle would tend to move with the *same velocity* (because the forces are all *equal*), and in the *same direction* (because the forces are all *parallel*). None can interfere with the motion of another in any way whatever, any more than if they were all perfectly unconnected. Hence, by applying such a force to the centre of gravity as will bring it to rest, we do not alter the *motion of rotation* round that centre at all, if there be such a rotation. Hence, we may always suppose the centre of gravity of a moving body to be at rest without altering the motion of rotation. This *simple* consideration will be found to *simplify* all problems wonderfully.

If any other point different from the centre of gravity had been taken and a force applied to it, this would not produce the *same* effect on *all* the particles. It is indeed capable of being replaced by a series of forces parallel to it, each of which is applied to its own particle, but these will not be *equal* to one another, and therefore the motion of one will interfere with that of another, whose tendency may be (on account of the *greater* force applied to it) to move *faster* (or slower).



Suppose G to be the centre of gravity, and a force P to act at any point A. Apply at B (G B = G A) two forces, each equal to ½ P, and parallel to it, in opposite directions. The application of these new forces will not in any way alter the previous state of the body. Then the ½ P at A together with the ½ P at B, which acts in the same direction, are together equivalent to P at G, *i.e.*, to their sum acting in same direction, and there remains the "couple" (½ P, − ½ P) whose arm is run, or whose moment = ½ P × run = P × G *m*; and this is the only part of the forces which influences the *rotation*, since the force at G, by what has been previously said, does not at all affect it.

If it be asked, *why* choose ½ P instead of P or any other force, as that which we apply at B; the answer is, that if P, for instance, had been chosen, and two parallel forces, each equal to P, had been applied at B in opposite directions, then the P at B and the P at A would compound a force = 2 P at G, and *leave a force P at B* without anything at A to counteract its influence on the motion of translation. For the same reason GB is taken = GA, because otherwise the resultant of the parallel forces would not act at G, but at some other point, so as to affect the motion of rotation.

Hence the action of any force P affects the motion of the centre of gravity, just the same as if it were acting immediately at that point, and affects the motion of rotation just the same as if the centre of gravity were fixed.

An example or two will illustrate this principle;

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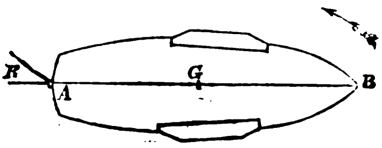

Let A B be the keel of a steam-boat, or any other kind of vessel. The action of the paddle-wheels is such by their position, that the resistance of the water always acts in lines parallel to the keel; the centre of gravity G moves on as if the whole of this force were applied directly to it in a line parallel to the keel. Suppose the rudder to be put in the position A R, the water impinging against it turns the boat round G in *exactly the same way as if G were a fixed point*: so that in the position of the rudder A R, the boat's head is turned in the direction of the arrow. The rudder therefore is put on that side towards which you wish the boat's head to go. Neither of these two motions would interfere with the others; but the boat goes on, and the point G describes the same path as before, were it not that by this turning round of the boat the *direction* of the moving force is altered—since the resistance of the water is always parallel to the keel. In the same way in a sailing ship, the alteration of the position of the rudder causes the ship to revolve round its centre of gravity, and thus presenting the sails at a different angle to the wind, the direction of the moving force is altered, and also the magnitude. In the proof of the preceding principle it must be remembered that the direction and magnitude of all the acting forces are supposed to remain the same—in cases such as this, therefore, where the direction, and also the amount of the forces, are *continually varying*, we require the application of the principles of the differential and integral calculus—which are not required when the forces are *constant* in magnitude and direction. But the *mechanical* principles required in the investigation are the same in both cases, and this separation of the more complicated motions into their constituent parts, by which we are enabled to calculate separately the effect of each, and then afterwards by combining them, find the result—is a very valuable aid, without which, indeed, very few problems could be solved. The next example we shall take will be the locomotive.

(*To be continued.*)

PROGRESS OF LIGHTING BY ELECTRICITY—*Mr. Staite's New Patent.*

Mr. Staite continues with great ardour and perseverance his laudable endeavours to render the light, attainable from electricity, available for practical purposes. We were favoured a few days ago with a private exhibition of an electric lamp, constructed according to his last patent. We have seen a larger volume of light produced from electricity, but never so large a volume from so small a battery power; and at no time, and in no case, a light of this description so long sustained and so steady. Lighting by electricity has been a favourite dream of many; but Mr. Staite is unquestionably the first scientific experimenter who has reduced it to (what we may almost venture to call) a practical certainty.

Amongst several applications which the inventor contemplates, may be mentioned one wheel we had the opportunity of seeing in operation, namely, telegraphing by means of flashes of light through coloured media. With four sets of electrodes, for example, placed in glasses, coloured white, red, green, and blue, the whole alphabet, with the numerals, are indicated, by a very simple code of signals, and with astonishing rapidity. The key-board of the telegraph is so arranged that each key in the series is coloured white, red, green, and blue; and when either key is pressed down, it completes the circuit, with that particular electrode, at the distant station which exhibits the same coloured flash. There may be any number of keys, and one to strike a bell at the conclusion of each word, or for the ordinary purposes of drawing attention, &c. For night signals on railways, Mr. Staite proposes to have fixed, at required distances from the stations, a signal-post, on which two, three, or more lamps may be fixed; say one enclosed in a red glass, one in green, and one in white. The battery-wires are so arranged, that whichever lamp is required to show a light, the attendant at the station completes the circuit accordingly, and *vice versâ*. The red light may indicate "danger," the green light "cau-

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tion," and so on. These lights may be shown at any distance *from* the stations, and be under the perfect control at the same time of the attendants *at* the station. We think such a system calculated to be of great service in preventing accidents at night, especially in dark or foggy weather.

Mr. Staite uses the self-sustaining percolating battery of Messrs. Brett and Little (under licence from the patentees); and he has, by this means, reduced the cost of the battery power to a minimum. Supposing the points of cost and continuousness to be determined in favour of the electric light, there can then be no question of its far surpassing every mode of illumination yet known.

Mr. Staite is constructing a lamp combining all his recent improvements, and intends shortly exhibiting it to the public at large.

The application of this light to coal mines (which is quite practicable) would be a great boon conferred upon them, inasmuch as it would ensure perfect safety in the foulest pits, the light being developed in a glass hermetically closed, and to which no explosive gas could penetrate.

"THE ENTERPRISE OF BROTHER JONATHAN."—RACE BETWEEN THE "BRITANNIA" AND "WASHINGTON."

A new line of steam packets has been started by "Brother Jonathan" to run between New York and Bremen—making a call *by the way* at the "old house," just to show how "young hopeful" is going a-head. The first of the line, called the *Washington*, started from New York on the 1st inst., at the same time with the *Britannia*; and the most confident expectations were entertained and expressed by the New Yorkers that she would not only eclipse her English competitor, but prove the most powerful vessel which ever steamed the ocean. "We have to say," so said the *New York Herald*, "that if the *Britannia* beats the *Washington* over, she will have to run by the deep mines, and put on more coal. We shall have, in two years' time, a system of Atlantic, Gulf, and Pacific steamers in operation that will tell a brilliant story for the enterprise of Brother Jonathan. We are bound to go a-head, and steam is the agent of the age," &c., &c. Well, the *Britannia* has positively beaten the *Washington*—not by minutes or hours, but—by two whole, full days—the former arriving on the 13th, and the latter on the 15th; and besides proving herself a very slow goer, she is universally pronounced by our nautical critics at Portsmouth, Cowes, &c., to be one of the ugliest steamers going. The result of the race is the more creditable to the *Britannia*, that her steam power turns out to be scarcely one-half that of the *Washington*. We subjoin a letter, received by the last mail from an intelligent English resident of New York, which, besides furnishing some interesting particulars respecting the *Washington*, shows that there were not wanting persons shrewd enough to anticipate the discomfiture that awaited her:

"The *Britannia* will leave Boston with this to morrow, June 1st, and the *Washington* leaves here the same day, so you will keep a keen look out to see which is in first. I say the *Britannia*, and this notwithstanding she has not more than half the steam power of the other. The *Washington* is stated to be of 2000 horses' power, and is 1750 tons, Government measure, or 2000 tons carpenters' measure; so you see her steam power is to her tonnage as 1 to 1, while the *Britannia* has only 1 horse power to $2\frac{3}{4}$ tons. To go a little, however, more into detail: both vessels have two cylinders, I believe, of the same diameter, viz. 72 ins., and both have side beam-engines; the stroke of the *Washington* is 10 feet, her boilers are able to carry (they say) 30 lbs. of steam; but if we allow her only 23 lbs. + 13 vacuum, she will be still double the power of the *Britannia* with 5 lbs. × 13 lbs., *i. e.* = 900 horses' power (450 × 2). I am now speaking of full steam, or at least both cutting off at the same point. The *Herald* (New York) says the *Washington's* wheels are 39 feet diameter, and $7\frac{1}{2}$ feet dip; but this latter is of course an error, and probably means $7\frac{1}{2}$ feet face; she has two boilers 36 feet × 15 feet on the plan: there are three furnaces, each 7 feet × 4 feet 6 ins. × 6 = 189 feet. Well, then, there you have data from which you may calculate how many horses' power can be got off that great surface with anthracite and blowers. Her recipient heating surface may be large; she has flues perhaps 12 ins. in diameter; but I have no further information on this point to give you at present. On the whole, you may take my word for it, that she is not what she is "cracked up for to be."

DELIVERY OF WATER.

Sir,—In Vol. XLII. of the *Mechanics' Magazine*, p. 150, are three tables of the delivery of water through hose, under given heads.

Now, Sir, these tables may be very well

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as data for calculation to the fireman, but, restricted as the discharges are by a $\frac{7}{8}$ inch jet, they are of no earthly use to the general artizan, who wishes to know how much water, under variable heads, a $2\frac{1}{2}$ inch diameter hose will discharge in a given time, with a $2\frac{1}{2}$ inch aperture.

Through the "tentaculæ" of your journal, may I be permitted to solicit some person to furnish the result of *real experiments* on this subject, with various heads or columns of water, and lengths and diameters of leather, and vulcanized or other elastic hose.

Perhaps Mr. Braidwood would confer this favour from his valuable and extensive stores of information.

I am, Sir, yours, &c.,

WM. RADLEY, Ch. E.

Barnsbury Park, June 21, 1847.

MR. JACOB BRETT'S ELECTRIC PRINTING TELEGRAPH.

Sir,—My attention has been called to a controversy, which has been going on in your valuable journal, as to the merits of several inventions in electric telegraphic communication, in which Mr. French has advocated the peculiar merits of my invention. I feel it proper to state, that although I am obliged by the good opinion Mr. French professes of my invention, I am in no way responsible for the details of his statements.

Perhaps you will allow me to add, that when certain arrangements, in which I am now engaged, are completed, I shall be prepared to come before the public (and I hope successfully) to sustain the value of my invention.

With respect to the assertion of "Tyro-Electricus," that Morse's is the only telegraph at present existing in the United States, if he wishes to ascertain facts, he will find that another telegraph, known as that of "Professor House's Printing Telegraph," is also in extensive operation in that country; and I beg further to add, that House's printing telegraph in America, and Brett's printing telegraph in England and Canada, are one and the same telegraph, Mr. House being joint patentee with myself.

I am, Sir, yours, &c.,

J. BRETT.

29, Parliament-street, 22 June, 1847.

TELEGRAPHY—COMPOUND SIGNAL ALPHABETS.

Sir,—In my letter, which you was kind enough to insert in No. 1245 of the *Mechanics' Magazine*, there exist two errors, through which I think my meaning is liable to be misunderstood. I am sorry to trouble you, because I think I made the mistake myself while transcribing from the copy which I kept.

The words *Blackwall Railway*, which occur in the fifth line of the fourth paragraph, should be *Blackwall Railway Telegraph*; and in the last line of the same paragraph, the date 1840 should be 1841. It would also have conveyed my meaning more clearly if the title had been, "Telegraphic Conveyance of Intelligence *by Compound Signal Alphabets.*"

I think it necessary to state this to you, because the system has never been *applied publicly* to anything else but the needle telegraphs, although a variety of other applications (including the one with lamps and flags) are mentioned in my description of the system, which was written some years back, and sealed and signed by witnesses. In the year 1841 I applied to Mr. Stephenson about it; but he told me that, however ingenious it might be, the directors of railways had made bye-laws to prevent trains from running in opposite directions on the same line of rails; and that, therefore, its employment was rendered unnecessary.

I am, Sir, yours, &c.,

GEORGE PETRIE.

June 23, 1847.

RECENT AMERICAN PATENTS.

[Selected from Mr. Keller's Exemplifications in the *Franklin Journal.*]

AN IMPROVEMENT IN FILTERS, FOR FILTERING WATER AND OTHER LIQUIDS. *William H. Jennison.*

The patentee says,—"Of the various substances which have been employed as filtering media, sponge has heretofore been deemed the least useful, from the circumstance that in its natural, or slightly compressed state, its pores readily admit and become clogged with the impurities, and in a very short time impede the passage of the liquid, and after these impurities have filled up the pores, it is very difficult to remove them; but, by a series of experiments, I have ascertained that, by submitting well-cleansed sponge to a pressure of about 5000 lbs., and retaining it in this compressed state, it will admit of the passage of water or other liquid through it, and retain the impurities outside. Having ascertained this fact, I have applied sponge thus compressed to the filtering of water and other liquids with great advantage in the following manner;—The sponge is torn into small fragments, and properly cleansed, to remove all impurities, and then, in a moistened state, I compress it under a pressure of about 5000 lbs., and confine it between two per-

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forated metallic plates, forming a diaphragm, which is placed in a case with a chamber on either side, so that the water or other liquid can be carried through it, first in one direction, and then in the other, so that the impurities, which are deposited alternately on its opposite surfaces, shall be readily carried off by the water or other liquid."

IMPROVEMENTS IN THE MORTISE DOOR LATCH. *Rodolphus Kinsley.*

The patentee says,—"In making mortise latches, much difficulty has been experienced in giving a form to the case to suit thin doors, and at the same time adapted to the reception and working of the mechanism, and the fitting of a mortise made entirely by boring, to avoid the labour of mortising with a chisel. This end has been sought by substituting the cylindrical for the square form; but, to adapt this to the reception of a properly formed tumbler, requires too great a diameter to suit a medium thickness, or thin door. But, by one of my improvements, I attain this desideratum by forming the cross section of the case of three circles; one in the middle, to form the thickness of the case, and two small ones, one on each side of, and bisecting, the middle one, to form the width of the case, so that a hole formed by boring one large hole and two smaller ones, will receive the latch case, the diameter of the large one being sufficient to give to the arch of the tumbler the required length, and the two small ones giving sufficient width for the working of the levers of the tumbler and the wings of the latch bolt, on which the tumbler acts, to operate it.

"My second improvement consists in so locating the hellical spring which protrudes the bolt within a recess therein, as to have one portion of it rest on a flanch connecting the two sides of the bolt, and the other end on a shoulder of the stud against which the permanent end of the spring rests; by means of which arrangement, much of the friction, and consequent wear, of the spring against the case, is avoided."

AN IMPROVEMENT IN DOOR LOCKS. *John H. Davis.*

The patentee says,—"The nature of my invention consists in fitting up the lock with revolving escutcheons, connected with a wheel inside the lock, in which there is a hole only large enough to admit the key, so that when the key is turned in the lock, the key-hole will be closed on both sides; and by means of a notch in said wheel, into which a pall falls, the escutcheons are fastened in a position covering the key-hole when the door is locked; the catch of the latch is so constructed that it can be reversed, making the the lock a right or left-hand one at pleasure."

IMPROVEMENTS IN THE CUT-OFF VALVES OF STEAM ENGINES. *Horatio Allen.*

Claim.—"1st. The combination of two slide-valves, having their simultaneous motions in opposite directions, with a single movable seat containing two openings, leading respectively to opposite ends of the cylinder, as described. 2nd. The combination of the levers, or beams, which give simultaneous motions in opposite directions to two cut-off valves, with a rock shaft, or shafts, having bearings on movable supports; said valves being any valves which are at liberty to pass over or into the openings which they are intended to close, and said supports of rock shaft being such that they can readily be raised or depressed at pleasure, in the directions of the alternating motions of the valves, without interrupting their movements."

LIST OF ENGLISH PATENTS GRANTED FROM JUNE 19, TO JUNE 24, 1847.

James Hill, of Staley Bridge, Chester, cotton spinner, for improvements in, or applicable to, certain machines for preparing spinning and doubling cotton, wool, and other fibrous substances. June 19; six months.

Samuel Keeling, of Hanley, Stafford, for an improved method of making candlesticks. June 19; six months.

James Murdock, of No. 7, Staples-inn, Middlesex, patent-agent, for an improved mode of manufacturing woven goods, figured on both sides. June 19, six months.

François Henri Bickés, of Mayence on the Rhine, gent., and Meyer Henry, of Colonial Chambers, Crutched Friars, merchant, for certain improvements in treating, manuring, or preparing corn, seeds, plants, and trees, and in fertilizing land. June 19; six months.

William Vickers, of Sheffield, steel manufacturer, for improvements in the manufacture of iron. June 19; six months.

Thomas Russell Crampton, of Adam-street, Adelphi, engineer, for improvements in locomotive engines. June 19; six months.

James Robertson, of Great Howard-street, Liverpool, for improvements in the manufacture of casks, and other wooden vessels, and in machinery for cutting wood for that and other purposes. June 19; six months.

John Obadiah Newell Rutter, of Brighton, gas-engineer, for certain improved methods of, or apparatus for, conveying intelligence. June 22: six months.

John Mackintosh, of Bedford-square, Middlesex, for improvements in engines to be worked by steam, or other suitable fluid, and improvements in propelling carriages and vessels. June 22; six months.

James Soutter and William Frederick Hammond, of the Spread Eagle Works, Limehouse, engineers, for certain improvements in the steam-engine, and in machinery for propelling. June 22; six months.

Henry Mapple, William Brown, and James Lodge Mapple, of Child's Hill, Hendon, Middlesex, for improvements in communicating intelligence by means of electricity, and in apparatus relating thereto, part of which improvements are also applicable to other like purposes. June 23; six months.

John Richard Watson, of Pentonville, Middlesex, gent., for an instrument for registering angles at sea. June 24; six months.

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LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED UNDER 6 AND 7 VIC. CAP. 65.

Date of Registration.	No. in the Register.	Proprietors' Names.	Address.	Subject of Design.
June 18	1102	Herbert Room	Birmingham	Portable pillar-shower bath.
19	1103	John and Charles Ratcliff	140, Suffolk-street, Birmingham, lamp and gas fitting manufacturers	Gas consumer.
,,	1104	John Coope Haddan	14, Lincoln's-Inn-fields	Spring stock.
,,	1105	R. Fawcitt	Skutterskelfe, near Stokesley	Draining plough.

Advertisements.

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Respectfully state, that they are now prepared to SUPPLY the PATENT GUN-COTTON (compressed for the convenience of carriage), in round and square paper cases, of 4 ozs. each, packed in boxes, containing 50 and 100 cases each, at the price of 3s. per lb., for ready money.

Also, in tubes or cartridges of... 1, 1⅛, 1¼, and 1½ inch diameter;
Containing .... 2, 4, 6, and 8 ounces each, at the
Additional charge of.............. 1, 1½, 2, and 2½ pence, each tube or cartridge.

For blasting in slate quarries, paper tubes will be supplied, 8 feet in length, containing 1 oz. of the Patent Gun-Cotton per foot.

4 Ounces of Gun-Cotton—equal in power to—24 Ounces of Blasting Gunpowder,

As proved in mortars, similar to those used by the Board of Ordnance, for the proof of Gunpowder.

Office, 23, *Lombard-street*, *London*.

The Idrotobolic Hat.

MESSRS. JOHNSON & CO., (Hatters to the Queen and Royal Family,) of 113, Regent-street, and of Vigo-street, London, have obtained Her Majesty's Letters Patent for the application of valves to the crowns of hats, and also for the use, in conjunction with the valves, of permanent air-conductors.

The air is admitted by the conductor—placed at the lower and back part of the hat—and is allowed to escape by the valve in the crown; so that the wearer can regulate the egress, and, consequently, the admission of the air; by which arrangement perspiration is allowed to escape, and any accumulation of moisture on the hat or head entirely prevented.

The peculiar advantages of these hats are that they are cool, light, and impervious to oil or grease, thus combining the desiderata so long sought for by the public.

Baldness Effectually Removed.

A SURGEON, residing in Cork, having, in the course of his practice, had his attention particularly directed to, and acquired great experience in, the treatment of capillary diseases, is happy to inform those persons afflicted with baldness (whether in youth or advanced life), that they may, by a most simple process, reproduce that necessary ornament—a fine head of hair. Parties applying will require to inclose a small quantity of hair, and a fee of Half-a-Guinea, by Post-office order, in favour of Surgeon EDWARD WILLIAMS, 13, Henry-street, Cork, when the necessary instructions will be forwarded by return of post.

Just Published.

The Indicator & Dynamometer,

With their practical applications.

By THOS. J. MAIN, M.A., Professor, R.N. Col., Portsmouth; and THOS. BROWN, Engineer, R.N.

London: Hebert, 88, Cheapside; and Woodward, Portsea.

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Achromatic Microscopes.
The Megaloscope (a new Optical Instrument).

WHITTAKER and Co., Ave Maria-lane.

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To Inventors and Patentees.

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E. GRANVILLE, Manager.

London, May 17, 1847.

NOTICES TO CORRESPONDENTS.

A. C. will be surprised at the long postponement. The article was quite overlooked at the time; otherwise it would have appeared immediately.

J. M.—" Sails and Sailing of Yachts." Very acceptable.

Communications received from J. E.—T. H. A.—Emilius—Mr. H. Spence—T. H. Y.—Mr. French.

CONTENTS OF THIS NUMBER.

LONDON: Edited, Printed, and Published, by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

END OF VOLUME XLVI.

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